PAINT and VARNISH Production

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHES

1956
REVIEW
OF THE
PAINT
INDUSTRY

REPORT TO THE
PAINT
INDUSTRY

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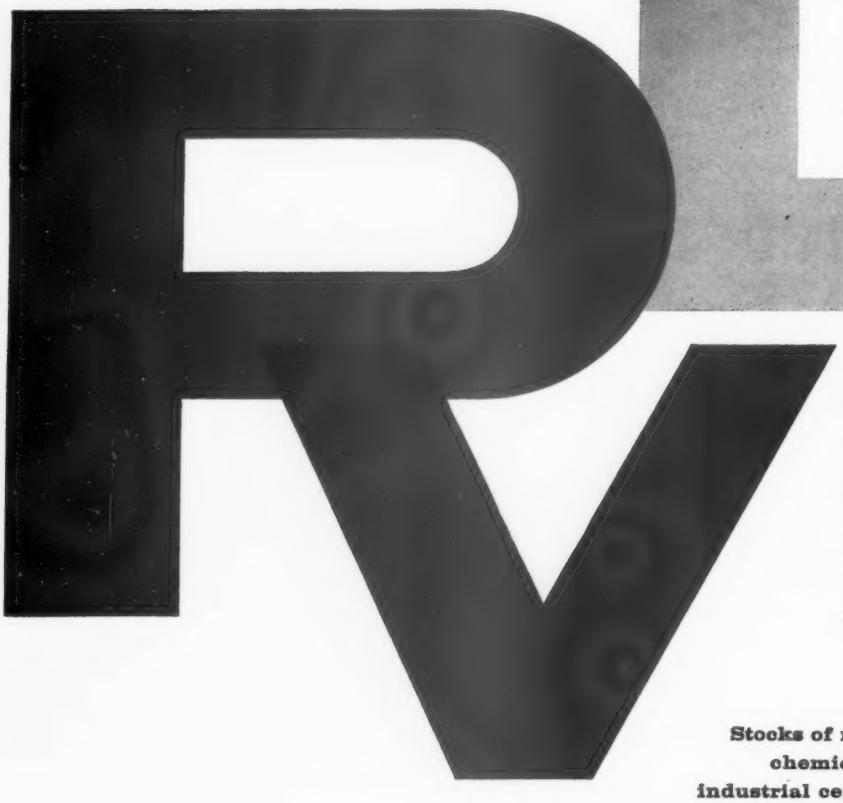

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HOW TO USE THIS REVIEW

THIS 1956 REVIEW OF THE PAINT INDUSTRY represents the fifth in a series of yearly summaries covering the technological developments in the paint industry. When used in conjunction with the previous (and subsequent) reviews, the series forms a valuable index to the technical literature and a source of information relating to the various phases of paint technology.

As illustrated in the Table of Contents, the material is presented in a related pattern. The format contains seven sections covering the following topics: Resin and Latices, Pigments, Solvents and Drying Oils, Additives and Intermediates, Architectural and Industrial Coatings, and Application Methods, Production, Chemical Methods, Analysis and Testing.

There are many ways to use this review to good advantage. The Table of Contents provides an overall picture of the format as well as presenting references to general subjects. The Authors' Index (page 84) is designed to aid the reader who recalls only the name of the writer of the information he is seeking.

The specific item refers the reader to the journal reference for further reading. Journal references appear at the end of each item. For example, the reference PVP 46 #2, 36 (1956) is broken down as follows:

PVP—Paint and Varnish Production (For codes of all publications used in this Review see page 8)
46 —Volume 46
#2 —2nd month of year (February) 1956
36 —The subject referred to begins on page 36

An added feature of the 1956 REVIEW OF THE PAINT INDUSTRY is a complete and up-to-date Product Listing (page 94) covering suppliers of raw materials and equipment of interest to paint manufacturers; addresses of these suppliers can be found on page 86. A complete compilation of suppliers' trade names appears in the Appendix on page 103. Trade Associations and their addresses are also included in the Appendix (page 93).

PUBLICATIONS

Listed below are the principal journals and their codes used in abstracting items which appear in this Review. All other abbreviations adhere to standards set by *Chemical Abstracts*.

AC	**Analytical Chemistry**
APJ	**American Paint Journal**
BP	**British Patent**
FL	**Farbe und Lacke**
IEC	**Industrial and Engineering Chemistry**
JACS	**Journal of the American Chemical Society**
JAOCS	**Journal of the American Oil Chemists Society**
JOCCA	**Journal of the Oil and Colour Chemists Assoc.**
JPS	**Journal of Polymer Science**
MC	**Makromolekulare Chemie**
MP	**Modern Plastics**
OD	**Official Digest**
PIM	**Paint Industry Magazine**
PM	**Paint Manufacture**
POCR	**Paint, Oil and Chemical Review**
PPV	**Peintures, Pigment et Vernis**
PT	**Paint Technology**
PVP	**Paint and Varnish Production**
USP	**United States Patent**

RESINS AND LATICES

GENERAL

Developments

A SOLUBLE air drying resin can be made when the reaction product of allyl alcohol and ethylene oxide is esterified with a substance such as maleic acid and then polymerized by a free radical catalyst in the presence of allyl alcohol as a gelation suppressor. USP 2,729,-623.

FLEXIBLE lacquers are prepared from a combination of a naphthalene-formaldehyde resin and a chlorinated paraffin. USP 2,748,094.

PHENOLICS, epoxys, and alkyds can be reacted with 4-10% of metal carbonyls to chemically combine the metals, according to BP 740,-346.

BALLANTINE *et al* exposed several polymers and monomers to γ irradiation and calculated the number of radicals per hundred electron volts. For methyl methacrylate and styrene, the G value was equal to that found by Tobolsky for β irradiation. The G value does not depend on temperature. Definite evidences of graft polymerization were found for several combinations. JPS, *19*, 219, 578 (1956).

A CHEMICAL theory for the mechanical degradation of polymers was investigated by Ayrey, Moore, and Watson. By incorporating free radical acceptors 1,1 diphenylpicrylhydrazyl and 1,1 dinaphthyl (S^{35}) disulfide into GRS rubber they showed that plasticization on mastication resulted from the rupture of the polymer into free radicals which could be stabilized from recombination by oxygen until they rearranged into degraded, smaller molecules. JPS, *19*, 1 (1956).

THE RAMAN spectrum of poly (allyl diglycol carbonate) indicates that the double bonds are almost completely destroyed during polymerization to a hard, transparent, thermoset plastic. Jeppeson, JPS, *19*, 331 (1956).

USP 2,726,228 claims the formation of a resin when a di α, β unsaturated ketone and an active carbonyl nitrile, or nitro compound is treated with a base and then heated to 2-300°.

DRUCKER and Morawetz copolymerized allyl amine and methacrylic acid to an amphoteric polyelectrolyte. The nitrogen content depended on the degree of ionization of the acid monomer and reached a minimum at 0.5. At high degrees of ionization, some lactamization takes place. JACS, *78*, 346 (1956.)

TETRAKIS(hydroxymethyl) phosphonium chloride reacts like formaldehyde to yield flame resistant, thermosetting polymers. A polyester with chlorendic anhydride was soluble in acetone but not in water or toluene. Reeves and Guthrie state that the melamine and urea resins impart flame resistance to cellulosic fibers. IEC, *48*, 64 (1956).

A SYMPOSIUM on the cure in thermosetting resins was published in IEC, *48*, 71 (1956). Papers appeared on the following topics:

Ultrasonic Waves as a Measure of Cure.
Cross-linking of a Phenol-Formaldehyde Novolac.
Reaction and Cure in Melamine Plastics.
Glycidyl Ether Reactions.
Epoxy Casting Resins Modified with Polysulfide Liquid Polymer.
Effect of Glass Fibers on Cure of Silicone Resins.

SZWARC, *et al*, determined the permeability of various polymeric films to hydrogen sulfide gas. IEC, *40*, 821 (1956).

AN AUTOMATIC temperature control unit for laboratory processing of resins was described by Mueller, *et al*. OD, *28*, 285 (1956). BP 736,968 describes the use of ultraviolet irradiation to harden film surfaces and thereby reduce the rate of release of pest controlling substances contained in the film.

FRICK, *et al*, studied the emulsion, polymerization of triallyl phosphate with halomethanes. A stable emulsion of negatively charged particles with low molecular weight and small particle size can be prepared and is useful for flameproofing. JPS, *20*, 307 (1956).

VINYL monomers can be polymerized by free radicals produced during the cold mastication of rubber. The system forms a soluble interpolymer or a two component gel, depending on the monomer used. JPS, *20*, 235 (1956). By laying down a film of a polymer exhibiting good surface properties and casting a second layer of a different polymer exhibiting desirable bulk properties before the first is completely set, Defries, *et al*, prepared dilaminar molded articles having the surface properties of the outer film and mechanical properties intermediate between the two resins. JPS, *20*, 267 (1956).

Natural Resins

SAPONIFICATION of lac resin with alkali destroys groups capable of reacting with sodium sulfite or alkaline peroxide. Kamath *et al*, find that halogenation with the Kaufmann reagent is essentially due to substitution, and hydrogenation studies confirm the absence of ethanoid unsaturation. J. Sci. Ind. Research (India), *14*, 555 (1955); *15*, 20 (1956).

DESTRUCTIVE distillation of black dammar resin results in a 75% yield of oil. By careful fractionation, a new sesquiterpene has been isolated. Dammarene ($C_{14}H_2O_2$) appears to be a bicyclic sesquiterpene with one exo and one endo double bond and can be dehydrogenated to cadalene. Ozonolysis yields an α,β unsaturated ketone with a methyl keto group which can be dehydrogenated to a blue azulene. J. Sci. Ind. Research (India), *14B*, 632 (1955); *15B*, 25 (1956).

Technical Bulletins:

Coating Resins—American Cyanamid Company

ACRYLICS

GRINSFELDER, Prentiss and Stankus discussed the formulation of exterior paints from acrylic emulsions. To overcome grain cracking on wood, a 25-30% pig-

ment volume was best, while on other surfaces a PV of 40-50 could be used. Where non-staining is important, talc is recommended as the extender, but calcium carbonate combinations are acceptable in other situations. Chalking can be controlled by 2 to 2½ pounds of titanium dioxide per gallon; a ratio of at least 70 rutile to 30 anatase is recommended, and should be higher for southern locations. Straight rutile TiO_2 is necessary for pastel shades. OD, *28*, 133 (1956).

ALKYL thiolacrylates were synthesized and polymerized by Marvel. The polymers have higher softening points than the corresponding acrylates. Synthetic rubber tests were close to standard GRS properties except for a higher temperature rise characteristic. The monomers copolymerized readily with vinyl compounds in bulk and in emulsion. JPS, *19*, 59 (1956).

KICE compared the inhibition of polymerization in methyl acrylate and methyl methacrylate and found it to vary with the inhibitor present. With strong electron accepting compounds such as benzoquinone and 2,6- or 2,5-dichloroquinone only a small increase in inhibition is found between methyl methacrylate and methyl acrylate, but with chloranil a large increase occurs, due to steric effects. JPS, *19*, 123 (1956).

KINETICS and heats of copolymerization of methyl methacrylate and acrylonitrile in a redox emulsion system were studied by Baxendale and Madaras. The steric strain introduced by a monomer reacting with growing chains of various end compositions is discussed. AN-MM • and MM-MM • have similar heats of copolymerization in formulations of low acrylonitrile content. JPS, *19*, 171 (1956).

MALEIC anhydride copolymerization with methyl methacrylate goes more rapidly as the maleic content is increased. MC *18/19*, 16 (1956).

NEW developments in acrylic coatings were described by Graeff. Combinations of solution resins with vinyls, cellulose acetate-butyrate and polyester-melamine systems were evaluated, and trends in emulsion systems for exterior use were noted. OD, *28*, 633 (1956).

COOPER and Catterall report that copolymers of butyl acrylate and methyl vinyl ketone can be cross linked by a combination of sulfur and zinc oxide due to the ketone present. Can. J. Chem., *34*, 387 (1956).

LAL and Green determined the intrinsic viscosity of solutions of alkyl polymethacrylates in esters of methacrylic acid. The viscosity usually decreases with increasing chain length. A high intrinsic viscosity of the polymer in the monomer is essential for successful polymerization within a reasonable time. JPS, *20*, 387 (1956).

IONIC derivatives of polyacrylamide have been made by Schiller and Suen. Anionic compounds were prepared by sulfomethylation with formaldehyde and sodium bisulfite and were tested as soil conditioners and drilling mud additives. Cationic polymers resulted from Hofmann degradation to the amine and imparted water repellence and ink resistance to paper when used in conjunction with rosin size. Aminomethylated polyacrylamide can be used as a flocculating agent. IEC, *48*, 2132 (1956).

ALLYL alcohol, which usually leads to low molecular weight polymers, has been copolymerized with acrylonitrile to a relativelv high molecular weight. Oster and Mizutani accomplished this by a dye sensitized photopolymerization. JPS, *22*, 173 (1956).

A LATEX made from a long chain acrylate ester, acrylonitrile, acrylic acid, and a monovinylidene aromatic hydrocarbon dries to a continuous adherent film at temperatures of 10°C. USP 2,767,153.

ALKYDS

CARRICK and Sun irradiated wet films of a short soya alkyd (containing driers) with γ rays from a Co^{60} source. After baking, tensile strength and elongation measurements showed that while irradiation reduces the induction period of drying, the physical properties of the fully dried film are unaltered. PVP, *46*, #2, 30 (1956).

A SERIES of alkyds made from mixtures of phthalic and isophthalic acids was described by Miner and Hind. Alkyds which reached a cure time of 20-30 seconds after processing at 200° C. for 8.5-11 hours will proceed to a gel, while others will level off in cure time and viscosity, indicating a relatively low degree of polymerization. A plot of log (cure time)$^{-1}$ vs. time is linear for rapidly polymerizing resins. An optimum ratio of dibasic acids at various oil lengths is described, yielding resins with low cure times at low acid values. OD, *28*, 17 (1956).

WAMPNER compared isophthalic and phthalic alkyds. Isophthalic long oil glycerine resins were superior to phthalic-maleic combinations at the same viscosity even though the isophthalic resins were longer in oil, but were inferior to phthalic-pentaerythritol combinations at equal oil lengths. A medium oil, benzoic modified isophthalic alkyd shows promise on exterior exposure and a very long tall oil resin performs well in house paint formulations. Isophthalic short oil alkyds show better impact resistance, higher gloss and more resistance to overbake than corresponding phthalic resins formulated to equal hardness. OD, *28*, 663 (1956)

MORT developed a conductivity method to follow alcoholysis. The resistivity of the oil layer decreases and finally levels off as the monoglyceride is formed. The rate of alcoholysis is very sensitive to temperature and catalysts. A 51% linseed oil alkyd made from a partially alcoholyzed oil containing 23% monoglyceride gave a lower viscosity resin and produced a softer enamel which tended to after yellow and wrinkle more than one made from a 41% (equilibrium) monoglyceride. The methanol solubility test was critically examined; different oils of the same monoglyceride content showed different

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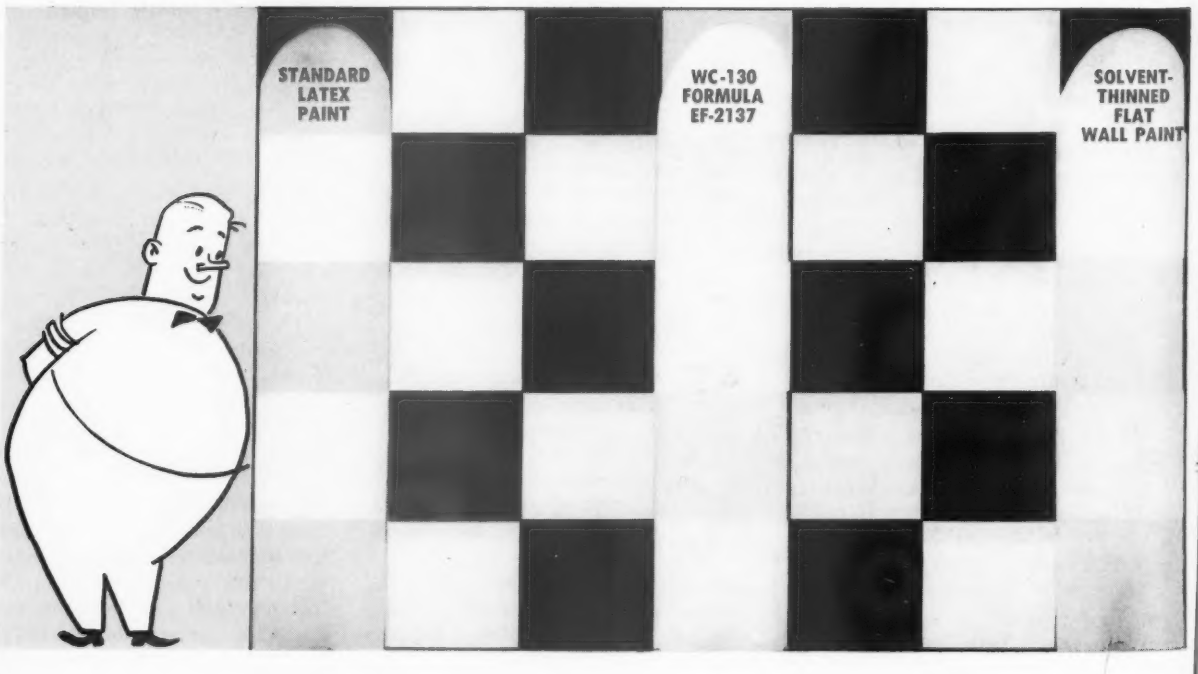

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FORMULA NO. EF-2139

White Interior Wall Paint 69.8% PVC

Formula:	Lb.	Gal.	Wt. %
BAKELITE vinyl acetate resin latex WC-130 (58.5% N. V.)	121.59	13.07	10.37
Titanium dioxide pigment[1]	148.32	4.24	12.66
"Lorite" filler	341.65	16.15	29.15
Water	390.59	46.90	33.33
Ethylene glycol	13.82	1.49	1.18
"Tamol" 731 dispersant (25% solution)	19.90	2.16	1.70
Ammonium polyacrylate (15% N. V. solution)[2]	12.86	1.46	1.10
CARBITOL solvent	17.73	2.07	1.51
Butyl CARBITOL acetate solvent	17.73	2.17	1.51
Dibutyl phthalate plasticizer	7.11	0.81	0.61
CELLOSIZE hydroxyethyl cellulose thickener WP-300 (7.5% N. V. solution)	71.86	8.43	6.13
Rust Inhibitor[3]	2.92	0.34	0.25
Pine Oil	1.17	0.15	0.10
Wetting Agent (25% solution)[4]	4.66	0.56	0.40
Theoretical Yield	**1171.91**	**100.00**	**100.00**

1 Rutile, semi-chalking grade, TT-T-425 Type II.
2 For example, "Good-Rite" K-707.
3 For example, "Nox-Rust" #702.
4 For example, 25% aqueous dispersion "Aerosol" OT.

MANUFACTURING PROCEDURE:

Preparation of Pigment Paste: Charge 68% of the water to a pebble mill. Add the 25% "Tamol" 731 Solution and pine oil, mix well. Add the pigments and grind for 24 hours.

Preparation of the Paint: Add the various components to a paint mixer in the following order: Agitation should be continuous during each addition and each component should be dispersed before the next is added. Pigment paste, ammonium polyacrylate solution, ethylene glycol, WC-130 latex, dibutyl phthalate, CARBITOL solvent, Butyl CARBITOL acetate, rust inhibitor, wetting agent, balance of water, and CELLOSIZE WP-300 solution.

PROPERTIES: Viscosity—1220 cps. (Brookfield, 60 rpm, #4 spindle.) 70 Krebs units (150 gram weight).
Non-volatile—49.75%.
Pigment-volume ratio—69.8%.
Weight per gallon—11.7 lbs.
Freeze stability—Excellent—3 cycles, room temperature to −6° F.

This formula is for release only to coatings formulators. Based on Bakelite Company Laboratory results, it appears to offer merit in performance characteristics. However, because of the possible variations in the nature and quality of some of the ingredients used in this formula and in the condition under which they are produced, Bakelite Company is unable to guarantee like or optimum values for all coating properties and performance data.

Data and suggestions made in this publication are not to be construed as recommendations to use any product in violation of existing patents covering any material or its use.

Effect of Filming Aid Concentration on the Scrub Resistance of Interior Paints Based on BAKELITE Vinyl Acetate Resin Latex WC-130

Pigment-volume Concentration, %	30	37.8	40	45	50	60	70	70
Weight Ratio * Pigment/WC-130 Binder	1.42/1	1.81/1	1.94/1	2.36/1	2.68/1	3.8/1	5.6/1	5.6/1
Parts Filming Aid (Plast.—Solvents) per 100 parts tot. paint solids	7.9	6.8	6.5	5.7	5.15	6.5	4.7	7.3
Scrub Resistance**								
No. of Cycles	950	1400	2000	2000	400	2000	190	1700
% Rubbed Off	50	50	3	10	50	0	50	60
	Stripping type failure—others failed by erosion						These test filming aid concn. vs. scrub resistance at constant pvc	

*Binder calculated as WC-130 solids with 10% dibutyl phthalate added.
**Scrub resistance measured on coats brushed on primed Morest charts, using 5% "Ivory" soap solution.

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BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

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but reproducible methanol tolerances. Centrifuging or washing the product free of glycerol did not affect the test. No linear relationship is found between the monoglyceride content and the alcohol tolerance. On continued reaction, the alcohol tolerance increases with no great change in the amount of monoglyceride present. JOCCA, *39*, 253, 265 (1956); Seaborne, *ibid.*, *39*, 262 (1956).

TAWN discussed problems in the fundamental study of alkyd chemistry and reviewed the most important papers in the field. The alcoholysis of trilaurin showed similar rates at 220° and 240° C., but increased considerably at 260°. Much polyglycerol was formed at 265°, but none was found at 240° or lower reaction temperatures. Low temperatures favor the formation of α-monoglycerides. The alcoholysis mixture could be fractionated chromatographically on a silica column and eluted with chloroform-acetone; ethanol was found to isomerize mono and diglycerides. Paper chromatography could be used, but analytical methods are not available for the detection of the small amounts of material which must be handled. Various solvent pairs were tried in attempting to fractionate alkyds by precipitation techniques. Petroleum ether retains long oil components, and methanol is useful for fractions of high phthalic content. Only small variations in hydroxyl value were found in individual fractions, suggesting a uniform distribution of free -OH groups. Alkyds could be fractionated by chromatographic adsorption, and initial work showed some success with paper chromatography and electrophoresis. JOCCA, *39*, 223 (1956).

BOBALEK, *et al*, followed the method of Armitage and Kut for the analysis of styrenated alkyds using tracer techniques. The method does not work in all systems. The extent of copolymerization is greatly dependent upon the conditions of synthesis. AC, *28*, 906 (1956).

ALKYDS made from non-conjugated fatty acids can be styrenated to clear products if 3-17% diallyl fumarate or maleate is also used. Low acid value alkyds were reacted at reflux for 6-7 hours with peroxide catalysts at a nonvolatile composition of 45-65%. Canadian Patent 521,711.

PINANE hydroperoxide catalyst is claimed to give high conversions of styrenated alkyds with relatively short reaction times. USP 2,743,249.

USP 2,730,517 claims the modification of alkyd type polyesters with β-keto acids by ester interchange at 100° with a litharge catalyst.

ALKYDS made with a poly-t-alkyl substituted benzoic acid modifier are said to have low viscosity and improved heat and light stability, mar resistance, and hardness. USP 2,729,609.

IMPROVED grinding liquids can be made from alkyds containing 5-20% rosinamine when 1-3% lecithin is added at the end of the process and dispersed by holding for 5-10 minutes at 400-500° F. USP 2,738,337.

POISSON chromatographed a 58% and a 40% oil length alkyd. The long oil resin had three main fractions of about 20% each, with glycerol phthalate contents of 12, 44 and 50%. The short oil alkyd gave four fractions of 22, 23.5, 12.5, and 13.5%, with glycerol phthalate contents of 23, 44, 74, and 77% respectively. An aluminum column was used and elutions were carried out with benzene, chloroform acetic acid. PPV, *32*, 39 (1956).

IMPERFECTIONS in flow as the cause of defects in alkyd films were investigated by Suppan and Wertheimer. Microphotographs show considerable differences in flow and coalescence for different alkyds spray-dusted onto glass panels at the same viscosity in xylol, while no differences are noted by a Gardner Flowmeter. The spread number is determined by pipetting exactly one cubic millimeter drops of liquid onto a microscope slide and determining the average diameter. The influence of concentration, oil length, viscosity, and type of oil used was studied by this method and some correlation between poor flow and deformation defects in the finished films were found. FL, *62*, 187, 268 (1956).

NORTH discussed paint formulation with thixotropic (polyamide modified) alkyds. Non-reactive pigments increase the gel strength about 30%. Reactive pigments or pigments which tend to flocculate, such as carbon black or monastral blue, greatly increase the gel strength. Organic reds yield weaker gels than the unpigmented resin. Increasing the pigment volume may cause the gel strength to increase (rutile), decrease (china clay), or remain the same (blanc fixe), and must be studied in each individual case. Decreasing the pigment particle size usually increases the gel strength, although china clay is one exception to the rule. Poor solvents (low Kauri-butanol hydrocarbons) increase the gel strength while alcohols show a strong decreasing effect and can be used to ease flow, as can varnishes or hard resin solutions. All gel strength tests tried showed large variations unless a standard 24 hour conditioning period was used. Ball milling promotes syneresis, but in general changes in milling techniques only alter initial appearance and properties and the paints will equalize in performance on storage. PM, *26*, 235 (1956).

THE REACTION between the polyamide and alkyd is probably due to interchanges leading to partial solubility, accompanied by 6-membered ring hydrogen bonding between amide groups. Viscosity curves taken on a Ferranti-Shirley viscometer are shown for several gelled alkyd systems. Reduction of the non-volatile content of a solution reduces the viscosity at high shear, but does not change the general shape of the curve. Each resin has a relatively constant viscosity over brushing shear range. A Brookfield viscometer at low speed was used for measurements of gel recovery after complete breakdown and can be correlated with sagging and levelling results. Blending of gelled alkyds with normal alkyds is said to yield intermediate properties in proportion

to the amounts used. JOCCA, *39*, 695 (1956).

THEORETICAL equations which can be derived from Flory's treatment of polymerization were used by Wiederhorn to predict the acid value of alkyd resins at the gel point. The equations given (for fatty acid and alcoholysis procedures with glycerine and pentaerythritol) are approximate, as simple assumptions must be made, but agree with experimental work where no reactive oil was present. The relationship

$$A.V. = \frac{KC^a}{\eta} + B$$

where B = acid value at the gel point, η = viscosity, and K and a are constants which depend on the solvent is experimentally valid, yielding a straight line for a plot of acid value vs. the reciprocal of viscosity. For optimum properties, the resin should be stopped close to the gel point. A graphical plot is useful for factory production, as it is possible to tell if an error has been made in the charging operation by noticing deviations from a standard curve, if the error is caught early enough, the batch can be saved by adjustment of the charge from the equations and equilibration at a low temperature. APJ, *40*, #2 (1956).

BOBALEK, Savage and Schroeder investigated solubility phenomena in dilute alkyd solutions from viscosity and light scattering data. Results in very dilute solutions were not reproducible and varied with time. An erratic variation of the dissymmetry coefficient for different members of the same series of alkyds is thought to be due to either the structural complexity of individual molecules or to association complexes among molecules or with the solvent. A high value of q leads to instability in dilute cyclohexane solution and more thixotropic paints. Cyclohexane solutions show clustering of up to thirty-five molecules in an aggregate. Butanol reduces the tendency to associate in cyclohexane, but promotes it in a methyl ethyl ketone solution; this effect, however, is reversed with a highly polymerized alkyd.

SOLVENT effect differences are greater with the more complex pentaerythritol alkyds. IEC, *48*, 1956 (1956).

THE DRAWBACKS of commercial styrenated alkyds are pointed out by a British user. The resins show relatively poor results in accelerated exposure, salt spray, alkali and solvent resistance tests. PM, *26*, 345 (1956).

A METHOD for making styrenated alkyds suggests esterifying to a low acid value by withholding a large amount of the phthalic anhydride, adding the monomer to copolymerize, and then adding the remainder of the dibasic acid and completing the esterification. USP 2,749,320.

CELLULOSICS

GEARHART and Ball continued their study of half second cellulose acetate-butyrate and determined the viscosities in thirty solvents. Alcohols greatly reduce the viscosity when present as 20-40% of the solvent, but beyond these limits increase it. Close-cut aromatic solvents are the most effective hydrocarbon diluents, but aliphatics present in industrial solvent blends greatly reduce their efficiency. Tetraisopropyl titanate in isobutyl alcohol is an effective

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crosslinking agent for cellulose acetate-butyrate, and when more than 5% is used, the heat and solvent resistance is greatly increased. A low viscosity formulation stored below 90° F. is claimed to be relatively stable. Aluminum must be anodized or chemically cleaned in order to achieve good adhesion, and paper coatings formulations should be given a 350° bake for 20 seconds for best adhesion, although certain inks remain troublesome. OD, *28*, 215 (1956).

AN INK made from a polyhydric compound resin base can be made completely dry and non smearing in one second if it is treated after application with a 50% solution of a titanium or zirconium orthoester, according to USP 2,737,799.

ETHYL cellulose is stabilized against photooxidation by 2,4 dihydroxybenzophenone. Batdorf and Gantz measured the fluidity of solutions of films which had been exposed for various periods as degradation leads to shortened cellulosic chains. Five percent of an antioxidant (p-tertiary amylphenol) is effective, but only one percent of the ultraviolet absorber is even better, and the best protection was offered by a combination of 0.5% antioxidant and 0.5% ultraviolet absorber which shows no degradation in thirteen months, as opposed to a complete breakdown of the control in ten months. The ultraviolet light is absorbed and dissipated as a non-destructive form of energy. OD, *28*, #379(2), 65 (1956).

HIRT and Bruxelles examined polyisocyanates and titanium organics as cross linking agents for cellulose derivatives. The isocyanates in general are too reactive and sometimes lead to hazy films because of atmospheric hydrolysis. Hydroxylated solvents must be used with titanium esters to prevent gelation, and methyl cellosolve and ethyl lactate, which chelate with the metal are especially useful. Triethanolamine titanate and octylene glycol titanate are similar to the esters but the acetyl acetonate complex is stable for 120 days in solution with nitrocellulose. 1-5% insolubilizes films of nitrocellulose or ethyl cellulose, although the films swell in acetone. Cellulose butyrate solutions are stable, but the films are not cross linked. Titanium acetylacetonate usually imparts a yellow color to films. An auto lacquer formulation showed improved hardness without a decrease in flexibility or elongation, but increased dulling and chalking on exposure and poorer heat stability. Pretreatment of aluminum with titanium organics does not improve the adhesion of lacquers. OD, *28*, #379(2), 90 (1956).

CELLULOSE esters and ethers plasticized with 1,6 hexandiol-di-2-ethylhexoate show no evidence of plasticizer migration. Resistance to water, heat, and ultraviolet are also claimed in USP 2,742,371.

GEDDES reported that trifluoroacetic acid swells and ruptures hydrogen bonds in cellulose derivatives. Micellar dispersion and esterification occurs, even with a partially acetylated cellulose, and evidence is given for a faster reaction at the primary hydroxyl. JPS, *22*, 31 (1956).

NITROCELLULOSE forms a thermally reversible gel in ethanol. Gelation is preceded by the growth of molecular aggregates which are also present in the melted gel. Newman, *et al*, found that the relative viscosity and the breadth of molecular size distribution greatly increase as the system gels, in a manner analogous to polymerization, while the rate of gelation is similar to crystallization in that it is very temperature sensitive. The gel cross links are crystallites. J. Phys. Chem., *60*, 648 (1956). The viscosities and dynamic mechanical properties of isophorone solutions of cellulose nitrate have been studied by Plazek and Ferry. The dependency of viscosity on concentration is similar to that of vinyl polymers.

EPOXYS

B.P. 737,272 claims the manufacture of heat hardenable varnishes produced by heating epoxide resins and drying oils at 450-580° F. until a homogeneous product is formed.

DANNENBERG and Harp studied the degree of cure and the analysis of amine cured epoxy resins. Residual epoxy groups could be determined by infrared absorption at 10.92 microns or by chemical means; samples are reduced to a particle size of less than five microns, swelled in hydrochloric acid-dioxane, and the residual acidity is titrated. Cure can be determined by a new method of hot point indentation or by swelling to equilibrium in dichloroethane vapors. AC, *28*, 86 (1956).

ALKALINE earth metal salts such as calcium alkyl salicylates can eliminate gas checking and frosting of epon esters, according to USP 2,730,510. Alkyl titanates improve the cure, hardness, adhesion, solvent resistance and dielectric strengths of epoxy esters. USP 2,733,222.

SHUR discussed the uses and limitations of epoxy resins and their combinations with other resins. MP, *33*, #8, 174 (1956).

WHEELER and Turner surveyed recent developments in the epoxide resin field, JOCCA, *39*, 346 (1956); PM, *26*, 157,321 (1956).

KEENAN described epoxide-polyamide combinations. These systems exhibit good pot life with a sudden increase in viscosity to gelation after a time instead of a gradual increase. Hardness of the film increases with aging. Freshly mixed compositions may be incompatible but will become homogeneous on standing. Optimum curing conditions are 120-150°C. for 30 minutes. Yellowing becomes pronounced at 150° and is very bad at 180°C. Pigments can be ground in the epoxy resin, which will tolerate zinc oxide. A carbon black paint failed various tests when baked, but performed satisfactorily when cold cured. Some combinations show increased drying speed if allowed to age before application.

THE CORROSION resistance of various types of epoxy resins is reviewed in a committee report. Corrosion, *12*, #4, *49* (1956).

JOCCA, *39*, 299 (1956). Mitchell, OD, *28*, 352 (1956) also reviewed

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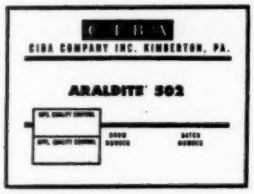

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polyamide-epoxy systems. Ott and Zumstein studied other polyamine cold setting compositions. Free aliphatic polyamines lead to incomplete cure, high sensitivity to moisture, poor heat resistance and inadequate durability. Complete alkylation of the amines improves these properties and lessens the toxicity, but does not alter the cure. A pre-prepared polyamine-epoxy adduct improves the cure but lowers the heat resistance. Polyamides are good, but the best all around properties are attained by the use of a resinous polyamine catalyst. JOCCA, *39*, 331 (1956).

BISHOP has used low molecular weight aniline-formaldehyde resins as curing agents for epoxy resins. They are said to be superior to aliphatic polyamines and equivalent to m-phenylene diamine, but a larger proportion can be used and the system is more conveniently handled. J. Appl. Chem., *6*, 256 (1956).

NORTH reported studies with epoxy esters. Cobalt and calcium are the preferred driers, while lead decreases the stability and shows no beneficial effects. Manganese slows the dry in some cases but can help prevent blooming under humid conditions. The resins wet less efficiently than alkyds, and zinc and calcium naphthenates are recommended grinding aids. Urea resin combinations adversely affect the chemical resistance and melamines promote gas checking, which is especially bad with dehydrated castor esters. The resins are claimed to have good durability, with failure occurring by poor gloss retention and erosion rather than by cracking or flaking. Epoxy esters are very sensitive to silicones of the antifoam type and in fact can lead to good hammer finishes. JOCCA, *39*, 318 (1956).

THE PREPARATION, chemistry, uses, and mechanism of action of epoxidation, epoxy compounds, and epoxy resins were reviewed by Swern. PVP, *46*, #5, 27; #6, 29; #7, 35; #8, 32 (1956).

EPOXY ESTERS have been copolymerized with styrene in the presence of drying oils to low viscosity products. USP 2,736,717.

GREENSPAN and Gall described the Becco *in situ* process for epoxidation, using a controlled molar ratio of acetic acid/hydrogen peroxide and a strong acid catalyst at 60-70°C. Reaction conditions, yields, and products are discussed for various ester and oil raw materials. JAOCS, *33*, 391 (1956).

EPOXY resins have been copolymerized with thiol terminated liquid polysulfide resins to permanently flexibilized materials with enhanced cure, wetting, adhesion, impact and thermal shock resistance. The coatings can be applied at 75-85% solids or hot sprayed at 100% solids and cured at room temperature. MP, *34*, #2,187 (1956).

HALOGENATED

FINELY divided chlorinated rubber is prepared by adding an aliphatic hydrocarbon diluent to a clear solution of the rubber and a maleic resin in an aromatic solvent until the finely divided rubber particles precipitate. BP 750,461.

SHANKWEILER reviewed the use of chlorinated rubber paints in corrosion resistant maintenance finishes. PVP, *46*, #4, 27 (1956). An infrared study of chlorinated rubbers indicates that a 6% chlorinated rubber retains its original unsaturation, and that "fully" chlorinated or hydrochlorinated rubbers still contain residual unsaturation. Ramakrishnan, *et al*, state that differences in absorption between free films and carbon tetrachloride solutions may be due to changes in the states of aggregation. JPS, *19*, 323 (1956).

USP 2,722,557 states that a stabilized chlorinated paraffin wax is produced by contacting the wax with up to 5% of a polyol.

HAUPTSCHEIN and Lesser copolymerized perfluoropropene and trifluorochloroethylene with ethylene oxide in the presence of ultraviolet light or peroxides to water insoluble polymers. Vinylidine fluoride did not copolymerize, but increased yields of homopolymer were obtained in the presence of ethylene oxide. JACS, *78*, 676 (1956).

MORTON, *et al*, found that the emulsion polymerization of chloroprene differed from other monomers. Dissolved chloroprene or monomer-water interface may both be loci of polymerization, depending on the conditions of the reaction. The polymerization was not dependent upon the solubilizing effect of the detergent micelles, but varied with the amount and type of initiator used. The polymer has a high rate of cross linking. JPS, *19*, 547, 563 (1956).

RUBBER can be reacted at low temperatures with hydrogen fluoride in a xylene solution until 75-70% of the double bonds are saturated. Tom reports that the product has good mechanical properties, thermal stability, limited solubility in aliphatic hydrocarbons, absolute resistance to ozone and small permeability to gasses. JPS, *20*, 381 (1956).

COPOLYMERS of 79-80% trifluorochloroethylene with vinylidene fluoride are useful for coatings on metals or fabrics where flexibility is not important. Below this amount the copolymers are rubbery. BP 742,907; 742,908.

POLYVINYL trifloroacetate is insoluble in its monomer. Haas, *et al*, found that the polymer was hydrolyzed to a polyvinyl alcohol which is insoluble, or else undergoes an irreversible gelation. The monomer can be copolymerized with vinyl acetate.

Technical Bulletins

Fact File on Diamond Chlorowax—Diamond Alkali Company.

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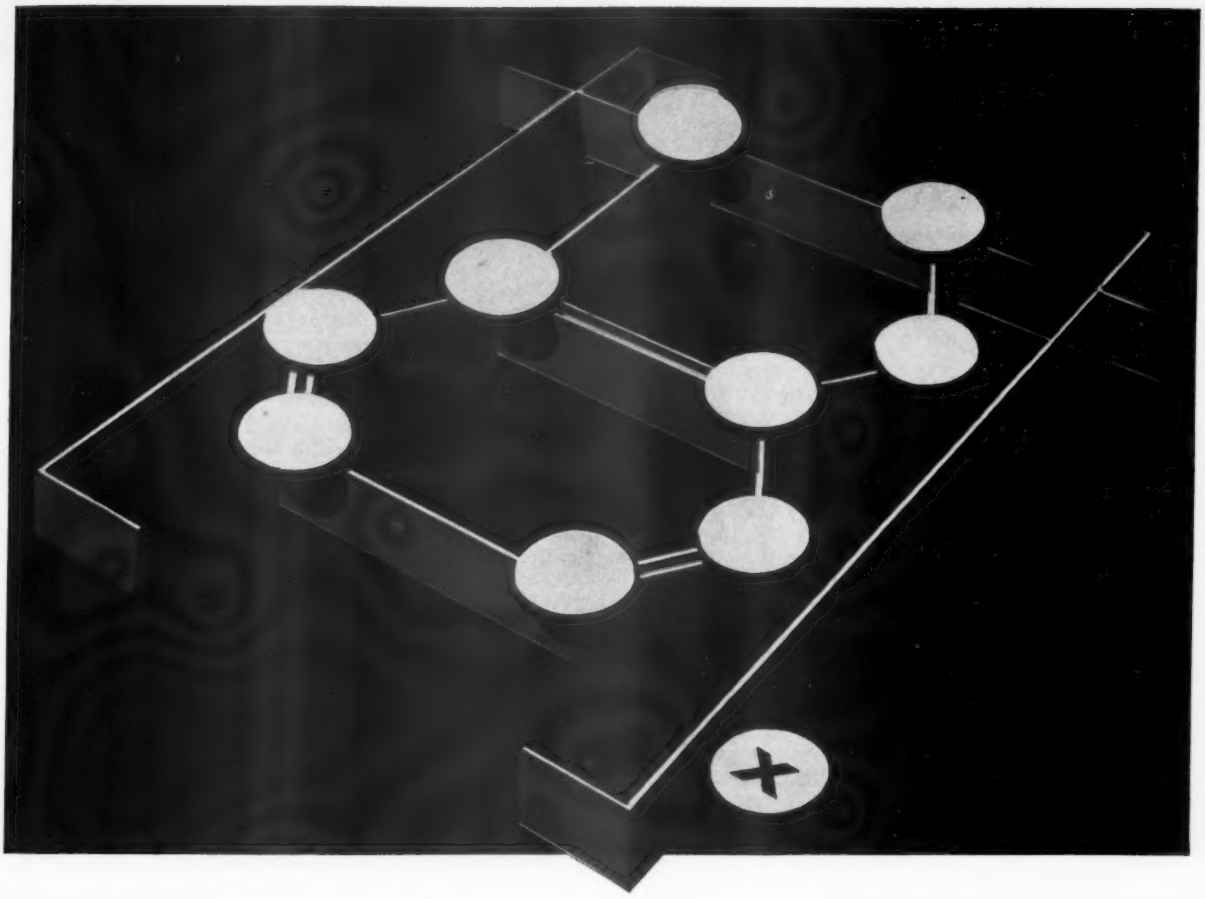

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THE HARDNESS of polymeric drying oils can be improved by reaction with an unsaturated or thiol substituted acid followed by esterification with an alcohol-amine and then treatment with a strong organic acid, according to USP 2,733,267.

THE EMULSION polymerization of butadiene with 1- and 2-chloroanthracenes goes better when benzene is added to the recipe. JPS, *21*, 251 (1956).

JACKSON reviewed recent developments in hydrocarbon resins, including resin emulsion modifiers for latex paints, vinyl toluene copolymers, and oil modified copolymers. Maleic adducts can be prepared with high maleic content when ditertiary butyl peroxide is used as a catalyst, although twenty percent of the maleic charged remains unreacted at any ratio of reactants. OD, *28*, 372 (1956). Coumarone-indene resins are upgraded by treatment with a formaldehyde releasing agent and an acid catalyst, according to USP 2,740,767.

THE KINETICS of the autooxidation of a polybutadiene were examined by Wilborn and Morgner and followed by gravimetric determination of oxygen uptake. With cobalt, one double bond disappears for each mole of oxygen absorbed. The peroxide forming capacity of metals is in the order Mn > Co > Fe > Ce > Cu > Pb > Rh > Ni > Zn > no catalyst. Amines and phenols, except for phenol itself, inhibit oxidation. At elevated temperatures, scission occurs with the loss of oxygen and CO_2, water, formic acid and tricarballylic acids were identified. The film loses its thermoplasticity at 6% oxygen uptake and becomes less elastic, tougher, and finally brittle. Deutsche Farben-Z., *9*, 457 (1955).

WATER impermeable coatings which are chemical resistant and corrosion proof can be made by copolymerizing tar or pitch with 5-25% of chlorinated rubber, polystyrene, or polyvinyl chloride at 140-180°C. in the presence of a metal redox catalyst and a stream of air. USP 2,734,882.

Technical Bulletins

Velsicol Technical Bulletins 219 and 203—Velsicol Chemical Corp.

Marvel, *et al*, copolymerized butadiene with pyridine analogs of chalcone. Substitution in the three position of the pyridine enhances the hysteresis properties of synthetic rubbers. IEC, *48*, 214 (1956).

NITROGEN

A COATING composition of a dispersion of a polyamide in an aqueous alkali metal silicate is claimed in USP 2,731,432.

AN INTUMESCENT coating can be made from a polyhydric alcohol, a long chain acid amide and formaldehyde or acetaldehyde condensed under slightly alkaline conditions and concentrated under acid conditions to produce a heat curable, water soluble binder. USP 2,722,523.

GRUNTFEST and Young used amine salts or amines in aqueous solutions at acid pH values to catalyze urea-formaldehyde condensation. The catalysts are inert in the presence of water, but become effective when the water is removed. The activity is destroyed if intramolecular neutralization or cyclization with formaldehyde occurs. Good storage stability is claimed for these systems-IEC, *48*, 107 (1956).

MORRIS discussed the advantages and disadvantages of amino resins in formulating industrial finishes. PM, *26*, 279 (1956).

AFTER studying the rate of weight loss on heating under different conditions for extended periods, Touchin concludes that all the butanol remaining at the end of the distillation step in the manufacturing operation is chemically combined. One step in the polymerization involves the elimination of butanol, yielding a methylene linkage for each mole lost. There is one butoxy group for 2-3 urea residues. The solvent greatly modifies the reaction rate of dimethylol dibutyl ether, a model compound related to the initial fast reaction in the resin, suggesting that the amount and nature of the solvent may influence the nature and properties of cured films. JOCCA, *39*, 653 (1956).

BAILEY, *et al*, studied the reactivity of organic isocyanates with alcohols and hydroxyl terminated polyesters by infrared spectroscopy. Electron attracting groups inductively increase the reactivity, ortho alkyl groups sterically reduce reactivity, and the mutual effect of two isocyanate groups is readily evident. IEC, *28*, 794 (1956). Mukaiyama and Hoshino found that as the acidity or basicity of the medium is increased, the rate of thermal dissociation of urethanes increases. JACS, *78*, 194B (1956).

A POLYURETHANE coating prepared from poly(ethylene adipate), toluene diisocyanate and crosslinked with ethanolamine was found to give good resistance to erosion on the leading edges of airplane wings. Reilly and Orchin found that the coating had a high tensile strength and good adhesion to aluminum. IEC, *48*, 59 (1956). Haven prepared organophosphorus di-isocyanates from phosphoric halides and silver cyanate. These compounds reacted with diols and diamines to form combustion resistant polymers. JACS, *78*, 842 (1956). The production of patent leather by coating the leather with an oil varnish and heating to tackiness is improved by contacting the product with diisocyanate vapors until the surface is completely dried. USP 2,741,566.

THE USE of polyisocyanates in the surface coating industry was surveyed. JOCCA, *39*, 609 (1956).

2-METHYL-5-VINYLPYRIDINE copolymers with butadiene and acrylonitrile form rubbers which can be made oil resistant by quaternation with organic halogen compounds. The resins resist swelling in alcohols, acids, caustic, hydrocarbons and ketones, and withstand deformation under heavy load without failure or crack growth. IEC, *48*, 1084 (1956).

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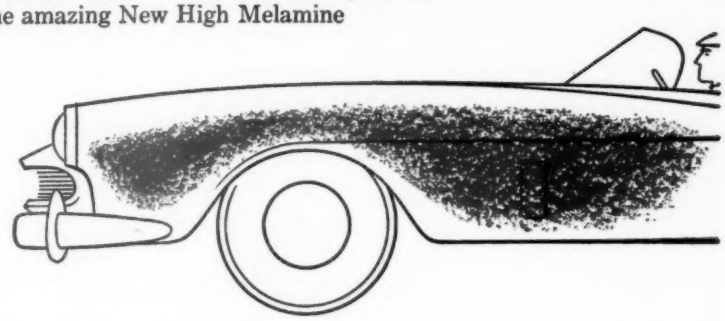

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ing with caustic and tall oil at a pH of 9.5-11 until a smooth dispersion is obtained, and then pigmented. USP 2,736,663.

LINEAR film forming polyamides are produced by condensation of 4-25% of 1,4 diaminocyclohexane with an equimolecular amount of adipic acid, ε-caprolactum and hexamethylene diamine adipate. USP 2,733,230.

TECHNICAL BULLETINS—Mondur-Multron Urethane Coatings—Mobay Chemical Co.

PHENOLICS

HAMMESFAHR, *et al*, discussed phenolic resin process design. The melt, grindability, viscosity, caking time and flow point of a resol resin are related to the water content and the stroke cure. A large series of variations in formulation and processing conditions were made and the resins were analyzed. It is possible to predict the type of resin obtained from a given set of conditions. The stroke cure is more reliable than viscosity measurements because of the temperature and water correction, but viscosity can probably be used for novolaks. MP, *33*, #6, 139 (1956).

BURKE, *et al*, studied the reaction variables in the preparation of linear phenolic resins from p-chlorophenol or its methylol derivatives and formaldehyde. The copolymers were completely soluble in dimethyl formamide and could be readily acetylated. Maximum viscosity was attained with 1.02 moles of formaldehyde per mole of phenol. Increasing the formaldehyde content led to cross linking and insolubility. Polymerization in a small amount of solvent yielded a high viscosity polymer which was mostly soluble, but a resin prepared in acetic acid was poorly soluble. Sulfuric acid and p-toluene sulfonic acid are comparable catalysts, but hydrochloric acid produces a viscous liquid polymer rather than a solid. Increasing the reaction time, temperature, or catalyst concentration increases the molecular weight. JPS, *20*, 75 (1956).

A RESIN prepared from butyl phenol and formaldehyde, esterified with fatty acid and reacted with 30 parts of styrene forms a coating with excellent alkali resistance and a fair water resistance. USP 2,731,428.

LIGHT colored phenolic resins useful in varnish preparations can be made by condensing polyhydric phenols with aliphatic compounds in the presence of tin compounds which form stannous ions and enhance the achromatic character of the resins. BP 743,345.

THE POLYMERIZATION of p-alkylphenols with formaldehyde was examined by Rosenthal, *et al*. Higher molecular weight products were obtained in closed systems. Butyl or amyl phenols yielded higher molecular weight polymers which were more stable to heat than the p-cresol condensates. Infrared spectra and chemical analyses were correlated with polymer structure before and after heat treatment. Can. J. of Chem., *34*, 679 (1956).

OIL SOLUBLE phenolic resins can be prepared by condensing a monohydric phenol with an aldehyde in the presence of an acid catalyst, dehydrating, and heating the condensate with an etherification catalyst in the presence of more phenol until the viscosity decreases. Novolaks can be reacted with styrenes to oil soluble products in the presence of an acid catalyst. BP 750, 233; 750,285; 750,286.

RESINOUS ethers result from the reaction of phenolic condensate adducts of monoepoxy compounds with aldehydes and alcohols or acetals. BP 749,788.

SILICONES

HARDENABLE silicones in electrical insulation lacquers were studied by Nowak and Rickling, who recommend a ratio of one methyl group to 0.65 phenyl groups for optimum strength and toughness. The phenyl group stabilizes the resins, which withstood conditions of 200° C. for over a year. Lead, the most effective hardener, lowered the thermal stability and impact resistance. Cobalt was much less effective, but offered a long pot life and did not have the tendency to show hairline cracks under the Ericson tests. An iron complex offered the best compromise as a catalyst. The resins, which could be heavily modified with fillers, showed poor adhesion to copper and were used to impregnate fibreglass insulation. Kunstoffe, *44*, 191 (1955).

ALKYL orthotitanates are used as catalysts for polysiloxane varnishes cured above 150° C., according to USP 2,732,320.

CURRY reported the synthesis and polymerization of organosilanes containing a vinyl group and hydrogen attached to the same silicon atom. The polymers were prepared by heating monomers with a platinum-carbon catalyst and contained the repeating group–($SiR_2CH_2CH_2$)–. Depending on the nature of R, mobile fluids or brittle glasses could be formed. JACS, *78*, 1686 (1956).

LAWTON, *et al*, initiated polymerization of solid hexamethyl cyclotrisiloxane with high energy electrons, but no reaction occurred in the liquid state. The polymer was cross linked. JPS, *19*, 455 (1956).

KRAUSS and Kubens studied the actions of various catalysts with silicone resins. Aromatic amines do not accelerate cure, but can reduce storage stability. Aliphatic alcoholamines considerably reduce the cure time, allow usable storage life, and do not affect the heat stability adversely except for yellowing. Metallic driers are made more active and more soluble by complexing with amines. Lead salts complexed with carbonyl compounds remain stable and strongly active for months, but the embrittling action of the led salt is unaffected. Combinations of active driers (Pb, Al, Ca) with weaker ones (Fe, Zn, Co, Mn, Ti) have strong accelerating activity but exhibit better heat and storage stability than strong catalysts alone. Driers improve the gloss of the films. Lampblack, silica, and talc pigments do not affect the drier action, but inorganic oxides and sulfides show improved cure and heat stability when driers are added. Deut. Farben-Z., *10*, 1 (1956).

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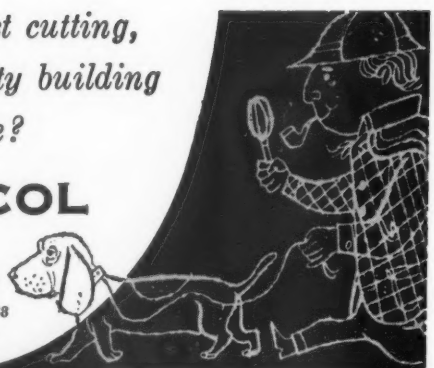

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Iodine Number	220 min.	130 max.	130 max.	130 max.	120 max.
Saponification Number	0-2	0-2	0-2	0-2	0-2
Acid Number	0-2	0-2	0-2	0-2	0-2

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THOMPSON copolymerized twelve vinyl silanes with vinyl chloride and acrylonitrile. None polymerized alone or with monochlorostyrene. The rate of copolymerization decreased rapidly as the concentration of alkoxy silane was increased. Vinyl trialkoxysilanes show the highest reaction rates. The copolymers were insoluble after drying. JPS, *19*, 373 (1956).

OIL modified organosilicone compounds can be prepared by reacting a diglyceride at 250°C. for 30 minutes with a silanol and distilling off the lower alcohol. The oil forms heat and hydrolysis resistant films when driers are added. USP 2,717,900.

BUBBLING is reduced during the cure of silicone resins when a long chain fatty acid is added. BP 743,312.

CAHN reviewed silicones and their applications in protective coatings. OD, *28*, 590 (1956).

PIKE and Bailey report that the structure of a vinyl siloxane does not affect the total rate of copolymerization or its reactivity towards a given vinyl monomer. The vinyl siloxanes are as reactive as vinyl chloride, vinyl acetate, or perfluoro vinylchloride, but less reactive than styrene, acrylonitrile, or N-vinyl pyrrolidone. The molecular weight, as well as the total rate, decreases with increasing amounts of siloxane in the charge. JPS, *22*, 55 (1956).

STYRENES

MARON, *et al*, studied the persulfate initiated emulsion polymerization of styrene and butadiene in the presence of carbon black. The rate of polymerization decreased markedly when conversion was carried above 50%. The carbon black settled out of latices above 30% conversion, but was easily redispersed. The rate was dependent on the type of black, the amount and type of soap and the method of preparation of the dispersion, but was insensitive to oxygen. It is better to disperse the black in the aqueous phase than in the oil phase. The polymers had improved tensile strength and elongation and were easily milled. JPS, *19*, 28 (1956).

THE EMULSION polymerization of 2-methyl-3-butyl-1, 3 butadiene and styrene resulted in an elastomer with poor low temperature flexibility and solvent resistance. The structure was predominantly 1,4. JPS, *19*, 51 (1956).

A CONTINUOUS process for the sodium catalyzed polymerization of butadiene-styrene is described in USP 2,728,801.

SZWARC, *et al*, found that styrene and alpha-methylstyrene polymerize instantly to products with a molecular weight of about 18,000 when added to trifluoroacetic acid. Acrylonitrile and monomers of similar polarity do not react in this manner. If the acid is added to the monomer, however, a slow reaction takes place resulting in an ester. High yields of the polymers can be obtained. JACS, *78*, 1122 (1956).

TREATMENT of alfin catalyzed polystyrene with normal hydrocarbons yields no extractable material, but produces a partially crystalline polymer, according to Williams, *et al*. JACS, *78*, 1260 (1956).

MILLER and Mayo oxidized styrene to a polymeric peroxide which was a poor initiator of polymerization or oxidation. JACS, 78, 1017, 1023 (1956). Indene reacts in a similar manner. JACS, *78*, 1035, 1041 (1956).

POLY $\alpha\beta,\beta$,-trifluorostyrene produced by emulsion or anionic polymerization yields clear films which are tough and flexible. The monomer dimerizes thermally and copolymerizes with styrene and trifluorochloroethylene in poor yield. Livingston, *et al*, found that thick specimens tend to show brittle fracture, but plasticization by chlorinated hydrocarbons is possible. JPS, *20*, 485 (1956).

SCHLATTER found that the sterically hindered 2.6 dimethyl-4-t-butyl styrene was polymerized by ultraviolet or di-t-butyl-peroxide to a medium molecular weight (1800-7700) resin. JACS, *78*, 3440 (1956).

INTERPOLYMERS of drying oils with high amounts of nuclear substituted styrenes and divinyl benzene are dispersible in mineral spirits to form air drying varnishes BP 752,045.

POLYESTERS

SMITH, *et al*, made cis and trans polyesters with isomers of 2-butene-1,4 diol and maleic or fumaric acids by transesterification. The all trans polymer is polycyrstalline and less soluble than the amorphous cis resin. With 2% benzoyl peroxide catalyst a film of the cis resin cured in 15 minutes at 100° C., while the trans resin took three hours under these conditions. Neither resin could be oriented. JACS, *78*, 626 (1956).

TITANIUM tetrafluoride and neodymium chloride have been found to catalyze the alcoholysis of terephthalic and isophthalic esters with glycol and polymerizes the glycol phthalates to linear polyesters. USP 2,729,619; 2,729,620.

BASIC FERRIC acetate is also said to catalyze the reaction. USP 2,740,768. Lithium hydride and a glycol soluble metal salt such as zinc acetate improve the yield of monomeric glycol terephthalate. BP 729,803.

THE COMPATABILITY of styrene with unsaturated polyesters in copolymerizations is enhanced when 5-tertiarybutyl isophthalic acid is used as the benzene dicarboxylic acid. USP 2,742,445.

DeSURVILLE dimerized linoleic-oleic acids at 360° for seven hours with 25% water present and separated the dimer by molecular distillation. The acid was condensed with linear aliphatic glycols in various solvents with several catalysts. A 20% nonvolatile solution in benzene containing an acid catalyst (10^{-4} x mol. wt. of glycol grams/gram dimerized acids) affords the optimum conditions, and a drying agent such as a anhydrous K_2CO_3

is necessary to obtain high molecular weights. Molecular weights increased with increasing glycol chain length. The polyesters have high fluidity, low vapor, high boiling points, and are odorless and soluble in most organic solvents, indicating usefulness as plasticizers. J. Recherches Centre Nat'l Recherche Sci. Lab Bellevue (Paris), *30*, 169 (1955); CA *48*, 16466 (1955).

KERN, *et al*, prepared linear polyesters with alcoholic end groups from succinic acid and excess 1,6 hexanediol. Phenyl isocyanate was reacted with the alcoholic esters and molecular weights up to 5000 can be determined by Kjeldahl analysis. Hydrolysis of the polyester diurethanes and sensitive photomeric analysis for aniline was used to measure molecular weights up to 80,000. Treatment with succinic anhydride in benzene solution yielded chain analogous polymers with carboxyl end groups. Molecular weights up to 7000 can be determined by direct titration. Reaction of phenyl isocyanate with polyester dicarboxylic acids in bulk is chain analogous, but with an inert solvent prolongation of the chains through carboxylic anhydrides occurs. Hydrolysis of the terminal acid anilides and analysis for aniline yields molecular weights which agree with the titration results. Two of the polyesters were fractionated by formation of urea complexes. MC, *16*, 75 (1955); *17*, 201 (1956).

THE RATE of copolymerization of unsaturated polyesters with mono olefins is greatly increased when a small amount of a compound such as dimethyl aniline is used in conjunction with a conventional catalyst such as benzoyl peroxide. Gelation at room temperature within a few minutes is claimed in CP 467,388.

POLYESTER resins containing a catalyst and stabilized by acidic or basic inhibitors can be activated by passage through an ion exchange resin to remove the inhibitor before heat hardening. BP 743,494.

DAMEN discussed the use of unsaturated polyester resins as surface coatings for wood. The polyester-styrene solventless system is cured at 40-60°C. with benzoyl peroxide as catalyst and a cobalt accelerator, allowing heavier coats with shock, heat, scratch and chemical resistance. Careful application techniques are required, such as cleaning of surfaces to attain adhesion and immediate cleaning of spray equipment to prevent clogging. PM, *26*, 407 (1956).

THE METHYL ester of trimesic acid is more easily reacted than the acid in polyester formation. Dunbar and Hutchins used butyl titanate as the transesterification catalyst. The acid itself is very resistant to ester resin formation, especially with solid alcohols, and the use of an inert solvent is ineffective. JPS, *21*, 550 (1956).

VINYLS

General

THE LENGTH of acyl chain in a vinyl ester does not affect the reactivity of either the monomer or the growing radical chain. Vinyl acetate and vinyl stearate were found to have similar reaction rates in copolymerization by Witnauer, *et al*. JPS, *20*, 213 (1956).

SEAVALL esterified polyvinylalcohol (MW 18,000) with linseed acids in phenol and obtained a 50% yield of the ester. No selective esterification of any one acid was found and no loss of unsaturation occurred, but some trans isomerization was detected. Most of the unesterified alcohol groups condensed to internal ethers. A ratio of one hydroxyl: three internal ether: ten ester groups is indicated by gross analyses, and one carbon in six carries a dienic or trienic side chain. Heating the ester at 290° C. for thirty minutes reduced the amount of ester, increased the soap forming materials and decreased the unsaturation of the fatty acids, without greatly decreasing the total unsaturation, indicating that the side chain fatty acids are polymerizing and split from the polymer by pyrolysis, leaving an unsaturated polymer. No evidence of interpolymerization between polyester molecules was found. JOCCA, *39*, 99 (1956).

VINYL epoxystearate has been prepared from vinyl oleate. The internal double bond reacts 220 times as fast as the vinyl group with peracids. Silbert, *et al*, prepared copolymers with vinyl chloride but found that external epoxy stabilizers are more effective. The homopolymer has a low intrinsic and specific viscosity. JPS, *21*, 161 (1956).

SMETS and Hertoghe studied the polymerization of vinyl benzoate. A three dimensionally branched resin occurs because of reactions involving the aromatic nucleus activated by the carbonyl function. Graft polymerizations with methyl methacrylate and vinyl acetate were made with molecular weights of 90,000 to 200,000. MC, *17*, 189 (1956).

TRIALKYL aconitates were copolymerized with butadiene, styrene, and other vinyl monomers by Marvel, *et al*, in bulk, solvent, and emulsion reactions. The esters are very reactive in free radical reactions while aconitic acid itself does not copolymerize. Rubbers had fair oil resistance but poor low temperature resistance. JPS, *20*, 437 (1956).

VINYL esters of aliphatic acids have been reacted with 2-butene-1,4-diol to produce copolymers containing up to 15% hydroxyl groups by weight. USP 2,740, 771; JPS, *21*, 340 (1956).

Vinyl Acetate & Vinyl Chloride

A POLYESTER of diethylene glycol and iso- or terephthalic acid and up to 35% benzoic or toluic acid is claimed as a plasticizer for polyvinyl acetate in USP 2,726,225.

GILBERT, *et al*, copolymerized vinylidene cyanide with fifteen monomers. Styrene, chlorobutadiene, dichlorostyrene and ethyl methacrylate were the most active co-monomers, while acrylic acid, vinyl chloride, dichloroethylene and maleic anhydride showed the least reactivity. When copolymerization occurs readily, a strong tendency toward alternation is found. With styrene, a rapid free radical cross initiation starts at room tempera-

ture in the absence of catalysts, and the polymerization can only be stopped by a high concentration of oil soluble inhibitors. With vinyl ethers, an autocatalytic ionic polymerization proceeds to the formation of two polymers, one containing a high concentration of vinylidene cyanide, the other high in vinyl ether content. JACS, *78*, 1669 (1956).

VINYL compounds polymerized in solution or in emulsion using a water soluble hydrazine disulfonate plus an oxidizing agent (bromates, iodates, periodates) have better color stability. The reaction will proceed at low temperatures. USP 2,729,624.

POLYVINYL chloride reacts with aluminum chloride and aromatic compounds in a Friedel-Craft manner, but the initial alkylation is followed by cyclization and poly 1,3 methylene indanes and formed. Teyssie and Smets report that the condensation reactions are always accompanied by a decrease in the degree of polymerization. JPS, *20*, 351 (1956).

THE EFFECT of particle size, degree of plasticization, and nature of plasticizer and surfactants on the freeze-thaw stability of polyvinyl acetate emulsions has been reported. A coarse particle emulsion of a very high molecular weight polymer with a maximum amount of pigment prevents coalescence of the polymer particles, while use of proper dispersing agents prevents flocculation of the pigment. A mixture of methylcellulose and sodium polymetaphosphate is recommended, and sodium dioctylsulfosuccinate helps. Ethylene glycol and ammonia offer only slight improvement. Verfkroniek, *29*, 108 (1956).

COGAN and Clarke present typical formulations for emulsion copolymers of vinyl acetate with higher acrylates and maleates. Agitation is not a significant factor in laboratory runs. An optimum temperature range occurs at 70-80°C.; below this, high molecular weight products are obtained in a slow reaction while higher temperatures lead to short chains and residual monomer. The smallest particle size was obtained when 5-15% of the monomer was charged initially. With a larger charge or with a high concentration of surface active agent a wide particle size range occurs. The rest of the monomer was added at 40%/hr.; at faster rates a wide size range of high molecular weight particles was found. Decreasing the protective colloid led to granularity, but less colloid or surfactant was necessary when hydroxyethylcellulose was used instead of polyvinyl alcohol. Increasing the catalyst has only a small tendency to decrease the particle size. OD, *28*, 764 (1956).

A COPOLYMER of vinyl chloride, a long chain diester of maleic, fumaric, or chloromaleic acids, a short chain monoester of these acids, and a small amount of trichloroethylene is suitable for solvent solution application. USP 2,731,449.

METHYL methacrylate can be copolymerized with vinyl chloride by first polymerizing the vinyl chloride in emulsion with potassium persulfate and, after removing unreacted monomer, adding deoxygenated methacrylate and continuing the polymerization in the dark at low temperatures. USP 2,746,944.

PALMER and Cass prepared a series of copolymers of vinyl acetate with dibutyl maleate or fumarate. The fumarate reacts faster, but copolymerization in either case is slower than homopolymerization of the vinyl acetate alone. The maleate is generally a better plasticizer, giving softer films with lower tensile strength and Young's modulus, and higher elongation. A continuous addition technique more suitable to large scale production leads to softer films. OD, *28*, 869 (1956).

Vinyl Stabilizers

$R_1Sn(SR_2)_3$ or dimers. USP 2,731,440.

$RSYCO_2Me$, where Y is a chain of 1-5 carbon atoms and Me = a metal of group II or IVA. USP 2,723,965.

$R_xSn\ (SCSOR)_{4-x}$ BP 740,397

Polyethylene

SLOWINSKI, *et al*, used infrared spectroscopy to determine the degree of branching in polyethylenes. Quantitative relationships were found between crystallinity and branching, and qualitative relationships are indicated for molecular weight, mechanical properties, and branching. JPS, *19*, 353 (1956).

IN ORDER to improve the bonding properties of polyethylene, Rossman subjected films to a glow discharge at reduced pressure or to a brush discharge from the high voltage side of a Tesla coil. Both carbonyl groups and unsaturation could be detected, but were present only on the surface. Abrasion removed the active centers and again presented a surface which no longer held printing ink. JPS, *19*, 141 (1956).

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LATICES

TURNER and Hodgson attempt to correlate the composition and property relationships in high polymer emulsions. The tensile strengths of all films reach a maximum 1-4 months after application, then decrease somewhat, and level off after 6-8 months. An externally plasticized polyvinyl acetate of 1 μ particle size reaches its maximum strength in a shorter time than a 0.15 μ latex, agreeing with the theory that maximum strength is obtained when the colloid left dispersed in the film is completely flocculated (occurs faster with larger particles). A 0.2 μ vinyl acetate-chloride was equal to the coarse PVA, while an internally plasticized copolymer (0.5 μ) fell between the two externally plasticized samples. With vinyl acetate, the water vapor transmission depends more on the polymer composition than on the protective colloids, emulsifiers, and plasticizers, but additives have a greater effect with the less permeable polystyrene. Small particle PVA had better water resistance, lower vapor permeability, and better durability than the coarse sample. The tendency for vinyl acetate to blister more than polystyrene is due to water absorption and dimensional changes in the film impairing the adhesion. Water resistance is greatly influenced by additives but PVA is inferior to styrene, acetate-chloride, or internally plasticized copolymer. Exterior exposure over an alkyd gloss showed that externally plasticized PVA chalked extensively, polystyrene flaked, acetate-chloride cracked, and internally plasticized vinyl acetate showed bad dirt collection. JOCCA, *39*, 114 (1956).

THE WASHABILITY and adhesion of water based paints can be improved by incorporating a water soluble alkali-metal salt of a hydrocarbon substituted silene triol. BP 743,685.

ACRYLIC latices containing multivalent metal radicals which are ionized in solution cross link on drying to insoluble films. USP 2,754,280.

A WATER soluble resin has been prepared by heating dicyandiamide, formaldehyde, and a surface active sulfonic acid salt at a pH above 8 until the condensate becomes nonprecipitable on dilution, but readily so on acidification. BP 736,197.

VANDERHOFF, *et al*, discussed the factors involved in the preparation of uniform particle size latices. The diameter of a smaller particle increases more rapidly than that of a larger particle, so adding monomer to a seed mixture of two monodisperse latices results in a latex with a narrower distribution than the starting mixture. The emulsifier concentration is critical; insufficient emulsion allows the latex particles to coalesce and coagulate, while an excess allows polymerization to initiate outside of the seed particle and new small particles are formed. If a polydisperse latex of small particle size is used as a seed, the polydispersity decreases with particle growth if coagulation and new particle growth is avoided. JPS, *20*, 225 (1956).

MUSCH evaluated butadiene copolymer latices in exterior paints. Redwood bleeds through all latices and must be primed with an oil primer. No primer is necessary over masonry. A butadiene-styrene-methylvinyl ketone terpolymer and a butadiene-acrylonitrile copolymer showed promise over primed wood, but several other copolymers checked and cracked. The latices may show no attack over extended periods and then suddenly completely fail. Inclusion of water soak and freeze cycles helps to correlate artificial weathering tests with actual results. A formulation study is necessary for each latex. OD, *28*, 362 (1956).

STABILIZED, glossy pigmented emulsions can be prepared by incorporation of water with a pigment which has been surface altered to a lipophilic state. The resultant paint is dispersed with at least part of the oil which is to form the discontinuous phase. The water in oil, pigment in oil dispersion is converted to a pigment in oil, oil in water emulsion. USP 2,719,133.

A STABLE colloidal water solution of urea-formaldehyde resin is prepared by warming 1.4-1.9 moles of formaldehyde with 1 mole of urea in neutral or acidic media until the solution shows a positive cloud test, then increasing the formaldehyde to 2.1-3 moles, acidifying to a pH of 2.5-6 and heating until a diluted neutralized (pH 7.3) sample shows a strong Tyndall effect, cooling and neutralizing. USP 2,729,611.

DUNN reported physical measurements on latex films during exterior exposure. Water permeability, water solubles, tensile strength, elongation, water sorption, and blister box tests were run on butadiene-styrene, internal and externally plasticized polyvinylacetate and acrylic films. Optical microscope indicates that none of the films are actually fused. Mica lowers the permeability and increases film strength and elasticity. With increasing pigment volume, vapor permeability increases while tensile strength and elongation decrease. Poor pigment dispersion leads to agglomeration and nonuniform film formation. OD, *28*, 564 (1956).

THE EFFECT of heat on the solubility of polyoxyethylene glycol and other monoesters was studied by Benerito and Singleton. The solubility of non-ionics varies inversely with temperature due to the destruction of hydrogen bonds. Amine derivatives are more soluble than the corresponding amides, while the ester derivatives have the poorest solubility. Emulsions made with a lipophilic-hydrophilic mixture are stable and have low particle size. If the inversion temperature is above 85°C. the low particle size is maintained and the emulsion does not separate when autoclaved. JAOCS, *33*, 364 (1956).

THE NUMBER of plasticizer particles necessary for the fusion of post plasticized polystyrene emulsion paints is independent of the compound used. Evans tested various plasticizers for tensile strength, weight loss, water resistance and scrub resistance effects and suggests trixylyl phosphate as a cost-performance compromise. There

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is some indication that pigment particles interfere with fusion. JOCCA, *39*, 553 (1956).

BECKER and Howell tested various methods to determine the critical pigment-volume concentration of emulsion binders. Tensile strength measurements show a parabolic curve about the CPVC and are suggested as a standard. Gloss measurements of enamel holdout lead to higher values. Scrub or stain removal tests do not have a sharp break and contain too many variables. A straight line relationship was found between the particle size of polyvinylacetate latices and CPVC, which decreases with increasing particle size. OD, *28*, 775 (1956). Osborne, *et al*, show that when the latex is used as a pigment binder, the greatest area of contact is desirable to result in the strongest film. TAPPI, *39*, 47 (1956).

SCHUMACHER, *et al*, conclude that neither the rate of freezing nor the package size is a factor affecting the freeze-thaw stability of a latex paint. The damage becomes worse as the temperature is lowered, and to attain extreme test conditions the paint should not be stirred. OD, *28*, 1021 (1956).

THE CRITICAL micelle concentration of polyoxyethylated nonionic detergents increases with ethylene oxide chain length and decreases with increasing electrolyte concentration. These compounds form hydrophilic micelles having weak positive changes. J. Phys. Chem., *60*, 657 (1956).

LATEX vehicles and paints undergo little shrinkage during film formation and curing. The volume of the voids may change following wetting and drying or during weathering. Browne states that water is absorbed and desorbed more rapidly than by oil based paints. Continued weight loss on soaking suggests slow hydrolysis to water soluble substances. Pigmentation and additives greatly modify the water sorption characteristics and their effects may be reversed in different latices. Forest Products J., *6*, 235 (1956).

PAINTS have been made from butadiene-methyl methacrylate copolymers containing 55-75% of the latter monomer. BP 749,719.

FINELY divided magnesium hydroxide can be used as a stabilizer in suspension polymerization under alkaline conditions. It is effective in low proportions and is easily separated from the polymer. BP 750,016.

MARCHISOTTO, *et al*, studied the stability of emulsion prepared from hard and distilled water. A chelating agent (di-sodium ethylenediamine tetra-acetate) in stoichiometric amounts greatly increases the stability of hard water emulsions. J. Am. Pharm. Assoc. *16*, 613 (1955).

ENZYMATIC press treatment of proteins such as casein confers excellent freeze-thaw stability to latex paints containing calcium pigments, according to Genin. Lait, *35*, 29 (1955).

FOUR SHORT papers of a symposium on media for emulsion paints discuss alkyd, polyacrylate and styrene emulsions and water thinned gloss paints. OD, *28*, 883 (1956).

SCHULZ presents data on vinyl acetate exterior paints after a 10-14 year period. Relatively large amounts of dibutyl phthalate are still left in the films. Small particle size PVA shows a higher water absorption which decreases on aging in laboratory tests at constant humidity and a hardening effect is noted in dry climates. The condensation product of formaldehyde with butyl urethane is suggested as a non-yellowing substitute for tricresylphosphate. OD, *28*, 1261 (1956).

PHOTOMICROGRAPHS with a phase contrast microscope show that films formed from emulsion always retain a structure derived from the original emulsion. The water solubles form a continuous structure throughout the film, but on wetting, the original structure again shows. Fletcher and Mayne discuss the difficulties in formulating emulsion gloss paints, which usually have inferior gloss, hardness, opacity and sheen uniformity. They recommend the use of rutile, incorporation of the pigment in the plasticizer, and acrylate thickeners. A levelling off of gloss occurs when the pigment-binder ratio is lowered to below 0.3. JOCCA, *39*, 923 (1956).

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PIGMENTS

PETIT and Lumbroso studied the leaching out of zinc chromate using radioactive Zn^{65}. The activity of single pigment linseed oil paints was checked over a period of five months and although some zinc was leached out during the first few days, no further solvation of the zinc ion occurred. PPV, *31*, 876 (1955).

HEAT STABLE inorganic colors can be obtained by adding as a binding agent a glass in which the silicic acid has been partially replaced by aluminum phosphate. BP 739, 569.

PHOSPHORUS activated luminescent zinc sulfide is prepared by heating in an atmosphere of phosphine. By controlling the concentration of phosphine, the ratio of yellow to blue emission is regulated. BP 741,616.

METALLIC lead has strong rust inhibiting properties and paints show excellent storage stability, flow, adhesion and toughness, useful as dual purpose primer and finish coats. On rusty surfaces, a straight oil medium is superior to a varnish. Electroplating and Metal Fin., *9*, #1, 14 (1956). Rust inhibiting pigments were discussed by Sherman. OD, *28*, 645 (1956).

VESCE discussed brilliant organic pigments which exhibit superior light fastness even when greatly diluted with titanium dioxide. Novel shades are produced with metallics and the range of vivid shades which has been only available with cadmium pigments is extended by blends of these pigments with molybdate oranges. Color chips, Munsell hues, formulae, and spectroscopic curves before and after one year exposure at Florida are presented for 36 pigments and their blends with titanium dioxide. Violet, blue, green, yellow, orange and red pigments are represented and their limitations as to useful concentrations, heat, and bleeding characteristics are noted. OD, *28*, #377 (2), (1956).

HYDROPHOBIC, organophilic pigments useful in printing inks or emulsion paints are made by treatment of the pigment with 3-10% of a high molecular weight pyridinium chloride. USP 2,742,375.

BUTLER and Copp found that lead dioxide decomposes thermally in air to an α-oxide close to Pb_7O_{11} and a β-form close to Pb_2O_3. The crystal structures are very similar. J. Chem. Soc. *1956*, 725.

KAUFMAN reports that the oil absorptions of micronized pigments are not always larger than conventional pigments; carbon black and Cr_2O_3 show lower values. The phenomenon is attributed to a reduction of the large internal pore volume on micronizing. Deutsche Farben-Z., *10*, 45 (1956).

McLAREN reviewed the spectral aspects of daylight which cause fading. The critical wavelength, above which radiation is non-active even though it is strongly absorbed, decreases as the resistance to fading increases. The differences between daylight and carbon arc radiation have been shown to be relatively unimportant as a source of gross anomalies, but they do account for the poor correlation found. J. Soc., Dyers Col., *72*, 86 (1956).

MARON, Bobalek, and Fok determined the surface area of carbon blacks by soap adsorption. For fine blacks, the nitrogen adsorption method gives larger areas because of surface irregularities. The soap method should give effective areas more equivalent to those encountered in interactions with larger molecules such as rubber. J. Colloid Sci., *11*, 21 (1956).

THE PREPARATION and properties of nonleafing aluminum pigments were treated in a paper by Torregson and Luyk. POCR, *119*, #14, 8 (1956).

JAENICKE showed that the maximum tinting strength of white pigments is related to optimum particle size by the formula $d = (0.9\pi\lambda/n_o)(m^2+2)/(m^2-1)$ where $m = n_o/n$ = ratio of the refractive indices of the pigment and the medium. With $\lambda = 0.55\mu$ and a linseed oil medium, the following are optimum particle sizes: barium sulfate 1.28, white lead 0.5, zinc oxide 0.47, zinc sulfide 0.47, zinc sulfide 0.30, anatase 0.27, and rutile 0.23. The influence of the pigment concentration, particle size distribution and particle form on the optical effects are discussed. Z. Elektrochem, *60*, 163 (1956).

THE HYDROLYSATE of TiO_2 from a sulfuric solution is a loosely flocculated gel containing grains of 0.6-0.7 microns. DeRohden states that the grains are actually agglutinizates of about 1000 grains of 60-75 mμ cemented by adsorbed SO_4 ions, with the smaller grains containing several microcrystals of 2 mμ which have acted as seeds. Chim. et Ind., *75*, 287 (1956).

A WATER dispersible titanium dioxide pigment is produced by flocculating in the presence of an organic acid which is volatilized during drying at 110-180°C. USP 2,744,029.

RIGG reviewed the history, manufacture, and uses of lithopone, with emphasis on its properties in water and emulsion paint systems. JOCCA, *39*, 809 (1956).

PETIT and Poisson discussed oxidation and reduction reactions of titanium oxides and hydroxides. In aqueous media, various organic materials reduce Ti(IV) to Ti(III) in the presence of light. With materials which can yield hydroperoxides, Ti(IV) is first oxidized to the pertitanic form and then reverts to its original state with oxidation of the medium. These reactions are much more marked with the hydroxide than with the oxide and are inhibited by fluoride ions. A dry film of linseed oil and titanium (IV) hydroxide is completely deteriorated by a month's exposure, but when the hydroxide is calcined with a fluoride the durability surpassed a commercial TiO_2 film. One percent of the hydroxide added to a commercial pigment leads to rapid destruction of a film. PPV, *31*, 975 (1955).

KRANZ prepared different chrome yellow and orange pigments and found that they catalyze the decomposition of hydrogen peroxide. This reaction can be used for control work, as it correlates with the tendency to darken on exposure to light. Physical properties of the pigments and their relationships to

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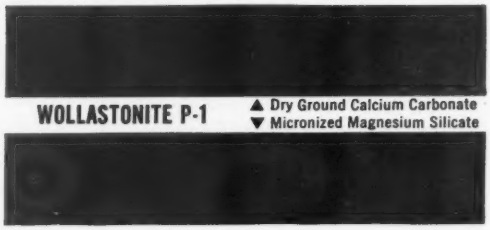

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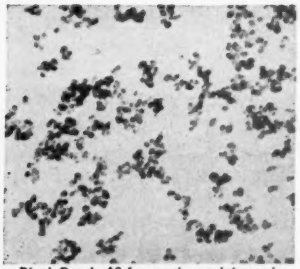

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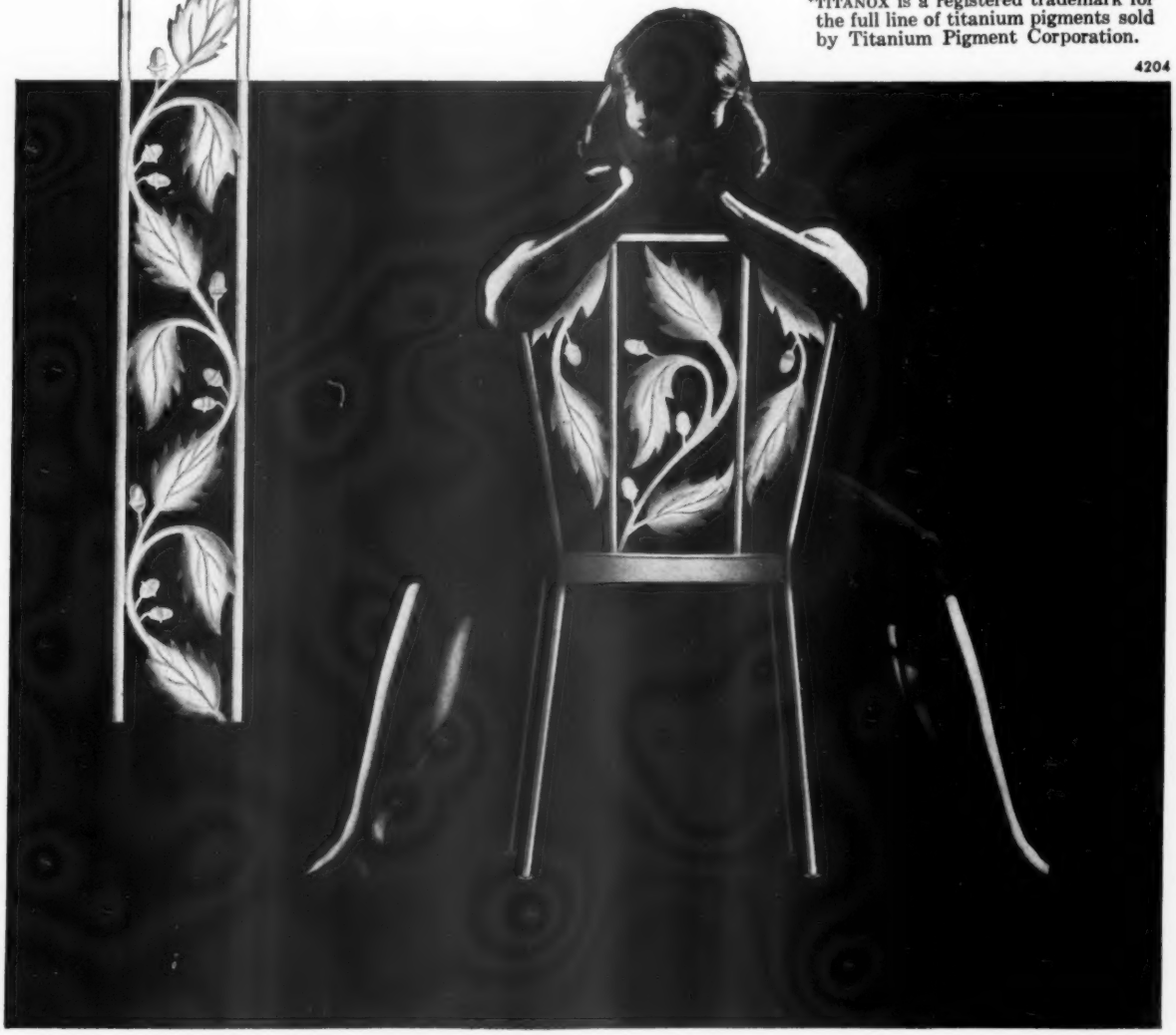

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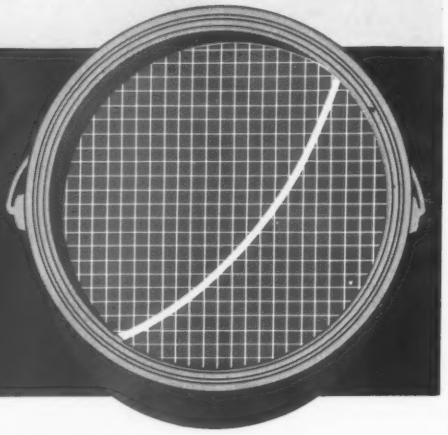

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pure lead chromate and sulfate are given. Przemysl Chemiczny, *1955*, 174.

AN ELECTRON diffraction study of white lead shows a disordered layer lattice with a $Pb(OH)_2$ sheet sandwiched between two $PbCO_3$ sheets. Cowley states that the layers approximate rhombohedral stacking but the deviations are such that a fully ordered structure would be triclinic. Acta Cryst., *9* (4), 391 (1956).

THE RUST inhibitive action of plumbates in linseed oil is said to be due to the oxidizing power of Pb(IV) on vic-glycols. Knudsen used a simple test to determine inhibitive action: extraction of the paint with water, testing a drop of the extract on sand blasted steel and examining the spot for rust after evaporation. An oil blown with red lead develops inhibiting compounds in 17 days. A litharge-oil blend has the same viscosity and soluble lead content after 5 days of blowing, but the aqueous phase is inhibitory only when left in contact with the oil for several days, suggesting the formation of hydrogen peroxide from auto-oxidation followed by oxidation of the lead to the +4 state. A faster development of inhibition occurs when calcium plumbate is added to litharge in linseed oil; this is not true with red lead. The presence of lead (IV) was shown by stearate precipitation. Oil blown with red lead has a much higher peroxide value than normal blown oil, and the analytical method measures the total oxidizing power (peroxides & Pb[IV]) JOCCA, *39*, 909 (1956).

A RUTILE titanium dioxide composite pigment can be produced by boiling a portion of titanium sulfate solution with an alkaline earth metal sulfate slurry to form a mixed precipitate, treatment with the remainder of the titanium sulfate solution, filtration, and calcining. BP 740,828.

CAMPBELL and Hughes report that a surface treated titanium oxide (Rutiox CR) acts as a protective pigment for the vehicle during exterior exposure. Their data fit the equation $R = R_o e^{-kw}$ where R and R_o are the rates of weight loss of

the pigmented and clear films, w is the weight fraction of pigment in the dry film and k is a constant for the test pigment. Since R_o depends only on the medium and the exposure conditions, it is possible to ascribe a k for any pigment. Similar equations are shown for the rate loss of the medium, rate loss of the pigment and the rate loss of film thickness, if the assumption is made that pigment and binder are lost in their original proportions. In the particular case cited, the pigment is released more rapidly as the PV is increased to 25, but above this the rate of lose of pigment does not increase with further pigment loading. JOCCA, *39*, 481 (1956).

GEORGE reviewed the use of diatomaceous silica in traffic paints. OD, *28*, 112 (1956).

STUDEBAKER, *et al*, treated carbon black with diazomethane and found that the surface contains oxygenated compounds of considerable chemical activity. IEC, *48*, 162 (1956).

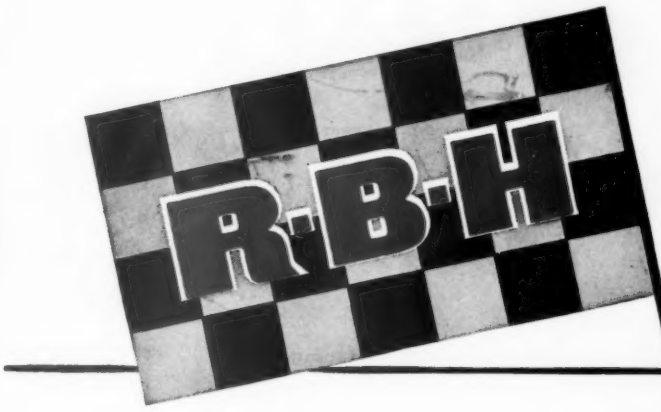
MICHAELS treated kaolinite and wollastonite with fatty amines and quaternary surfactants and found that the products improved the strength, stiffness and water resistance of highly filled plastics. The treatment is effective only with fillers which do not disperse well in the resins. Excess surfactant or treatment of easily dispersed fillers is detrimental. When used with resins of low polarity, such as GRS or polystyrene, the treatment enhances the uniformity of distribution of the filler and allows preferential wetting of filler particles by the resin. IEC, *48*, 297 (1956).

THE BLANCHING properties of a calcium sulfate pigment can be lowered by mixing with 0.1-0.5% of low molecular weight straight chain primary amines. BP 744, 559.

KING compared wollastonite to other extenders in poly (vinyl acetate) paints. The pigment contributes good freeze-thaw stability, holdout, and resistance to polish and abrasion. Paints are held at an alkaline pH which reduces can corrosion, effects better color development, and inhibits rust formation. APJ, *40*, #36, 76 (1956). The uses, flatting efficiency, moisture susceptibility and settling stability of synthetic silicas have been reviewed. OD, *28*, #379(2), 9 (1956).

Technical Bulletins

Characteristics of Holland Colors—Holland Color and Chem. Co. Syloid 244—Davison Chemical Company.



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Distillation	(D-86)°F
IBP	348
50%	360
End Point	402
Flash Point (D-56)°F	128
Color (Saybolt) (D-156)	30
Specific Gravity 60/60	0.761

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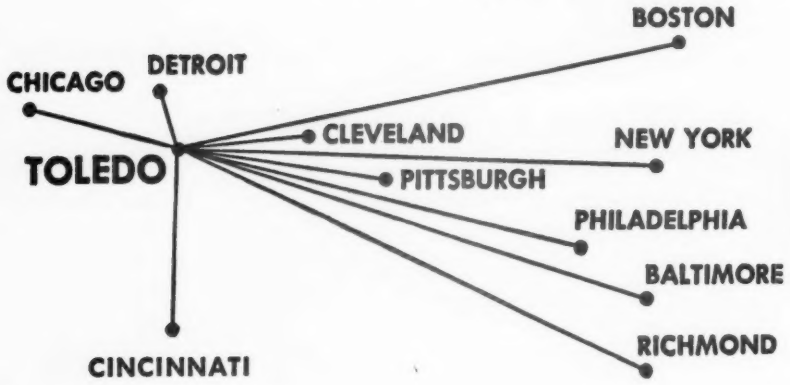

SOHIO

SOLVENTS AND DRYING OILS

SOLVENTS

McMASTER described the "high film build" thinner in lacquer formulations for spray application. The combination of high and low boiling solvents allows heavy coats without sag, orange peel, or dry spray as the large droplets are broken into fine particles without the entrapment of air when the gun is held far enough from the surface. PVP, *46*, #2, 27 (1956).

DAGGETT reviewed the formulation of industrial paint removers. Water and other diluents have a greater effect in reducing the activity of solvents than suggested by their concentration. Emulsification of solvents prevents contact with the surface. The lowest boiler in a series is usually the most potent solvent, and may not evaporate as rapidly as the next higher homologs because it bites into the film. Solvents, thickeners, evaporation retarders and their actions on substrates of various types are discussed. PM, *26*, 45 (1956).

WRIGHT examined multicomponent solvent mixtures and their effects in lacquers. Bulk evaporation rates followed individual solvent rates. No differences were noted between evaporation of solvent mixtures and elimination of 80% of the solvent from resin solutions. Up to 6% of the volatiles remain after a six hour air dry. A higher tensile strength results if the high boiling component is a poor solvent. Solvents have no effect on adhesion of a film. JOCCA, *39*, 129 (1956).

THE UTILITY of the nitroparaffins as solvents for coating materials was reviewed by Ashley. They are medium evaporating, relatively nontoxic materials with high flash points, low water solubility and unique solvency characteristics. APJ, *40*, #38, 104 (1956).

HARLINE and Scheibli found that Shell Evaporometer results parallel actual evaporation rates of hydrocarbon solvents from alkyd resins. Aromatics and naphthenes show decreased rates from films. Up to 20% of high boilers will not affect the initial rate (30%), but have a large effect on the final 50%. On the other hand, 10% of low boiling thinner has a significant effect on the initial and total evaporation rates and can affect lap time. No correlation was found between initial evaporation rates and ASTM distillation data. OD, *28*, 685 (1956).

SHUR, *et al*, present evaporation data for hydrocarbon and oxygenated solvents using the Shell evaporometer. The reproducibility of evaporometer results among different laboratories was found to be ±5%. OD, *28*, 1060 (1956).

The instrument itself and its use as a guide in formulating lacquer thinners were described by McGuigan. PVP, *46*, #12, 31 (1956).

CYCLOHEXANONE, heptane, methanol, ethanol, and ether containing dissolved oxygen loosely coordinate with it. The complexes are dissociated by boiling or bubbling nitrogen through the solvent. Nature, *177*, 587 (1956).

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DRYING OILS

BLACKMORE published an initial summary of the results of the nine-year research program of the Federation of Paint and Varnish Production Clubs. JOCCA, *39*, 9 (1956), OD *28*, 316 (1956).

GIBBLE, *et al*, described a semi-micro procedure for the separation and degradation of long chain fatty acids, useful in studying isotopically labelled products. The procedure has been used to systematically remove six carbon atoms from stearic acid. JAOCS, *33*, 66 (1956).

Drying Oils

RAO and Arnold determined the solubility of corn, linseed, and tung oil in ethanol at various concentrations and temperatures. The critical temperature varies linearly with the alcohol composition. JAOCS, *33*, 82 (1956).

AN EXTENSIVE review with 127 references to applications of infrared spectrophotometry in isomerism, auto-oxidation, polymerization, etc. of drying oils, including a table of useful absorption bonds appears in JAOCS, *33*, 1 (1956).

CANNON used counter-current extraction to isolate fractions of linseed oil containing from two to nine double bonds. A random distribution of glycerides occurs. JAOCS, *33*, 46 (1956).

VON MIKUSH reviewed the preparation, analysis, and properties of conjugated drying oils. OD, *28*, 44 (1956).

INDIAN varieties of cassia seed oils contain 40-50% linoleic acid, 28-35% oleic acid, and no stearic acid. JAOCS, *33*, 21 (1956).

KYTE reports that salmon egg oil, available from wastes, has a 220 iodine value and remains fluid at −35°C. 45% of the acids are 20 or 22 carbon atoms long and are highly unsaturated. JAOCS, *33*, 146, (1956).

GREENFIELD briefly reviewed the characteristics of beta tung oil APJ, *40*, #22, 100 (1956).

THE COMPOSITION of castor oil has been critically re-examined by Sreenivasan, *et al*. By careful saponification and esterification at room temperature, it is possible to avoid estolide formation. Hydroxy esters were reacted with succinic anhydride and hydrogenated without cleavage of the hydroxyl groups. Dihydroxy stearic acid was determined with periodic acid. Castor oil from several sources was found to be fairly uniform, and differences noted by previous investigators is attributed to difficulties of the analysis—estolide formation, conjugation, and the temperature dependence of Wijs' method. JAOCS, *33*, 61 (1956).

A COLOR stable, bleached vegetable oil is produced by heating under an inert atmosphere with an acylating agent. USP 2,727,051.

HEATING conjugated oils with alkylated benzodioxanes prevents wrinkling or frosting. USP 2,730,-451.

MONICK and Treyba presented data on the continuous counter-current extraction of saturated monoglycerides. JAOCS, *33*, 193 (1956).

KAMALA seed oil has been found to contain 18-hydroxyoctadeca 9,11,13-trienoic acids as the principle constituents. Its utilization in varnishes was described by

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Aggarwal. J. Sci. Food Agric., *6*, 364 (1955). Petit examined the oil of *L. iberica*. It is much faster in drying than linseed, but causes rapid yellowing and is unsuitable for white paints. Alkyds can be prepared from it. Rev. franc. corps gras, *3*, 272 (1956).

ARIES and Wolkstein reported on the esterification of tall oils with glycerine. Acid numbers were run in methanol-benzene and saponification numbers were determined by refluxing with potassium hydroxide in carbitol. Optimum reaction temperature was found to be 275°C., as decarboxylation or decomposition sets in above 310°. Catalysts had little effect. Fatty acids are almost completely esterified before the rosin acids, and below an acid number of 60, the rosin acid number and total acid number are almost the same. High temperatures are necessary to achieve low acid values. APJ, *40*, #44, 72 (1956).

THE ANALYSES of 300 samples of linseed oil were tabulated by Pouchon and Massoni, who list the following average values: iodine no. 185, linolenic acid 53.6%, linoleic acid 14.4%, oleic acid 23.6%, saturated acids 8.4%. PPV, *32*, 217 (1956).

Alcoholysis

HARTMAN found that sodium methoxide and ignited potassium carbonate were the best catalysts for methanolysis of oils, giving a 99+% recovery of glycerine in thirty minutes.

CALCIUM oxide produced a 98% yield in four hours. JAOCS, *33*, 129 (1956).

ROSSI, *et al*, found an induction period that varied with the type of oil during glycerolysis, but that the reaction rate was the same for olive, coconut and linseed oils beyond this point. The induction period can be decreased or eliminated by adding 10-20% of monoglycerides at the start, but the use of monoglycerides does not eliminate the necessity for a catalyst. The catalyst is said to act as a radical transfer agent. Chimica Industria (Milan), *37*, 356 (1955).

BY OPERATING at temperatures just below the melting point of a fat, interesterification with a sodium-potassium metal catalyst only takes place in the liquid phase and can be directed towards the formation of trisaturated glycerides which then precipitate. A pilot plant unit for the process is described. JAOCS, *33*, 29 (1956).

A PROCESS for the alcoholysis of fats, oils and waxes over a heterogeneous zinc silicate catalyst at the critical pressure of the alcohol is described in USP 2,727,049.

LANSON treated soybean oil with conjugated linseed fatty acids and anthraquinone at 300° C. under nitrogen for three hours and then removed the excess fatty acid (I.V. = 100) by steam distillation. The residual oil dried more rapidly and had better water resistance than linseed oil. Milkweed seed and fish oil can also be upgraded to drying oils by this acidolysis procedure. JAOCS, *33*, 68 (1956).

Oxidation

DUGAN and Landis studied the influence of α-irradiation on the oxidation of oleic acid and methyl oleate. A marked effect is noted even at low temperatures. High peroxide values were found, but much secondary reaction occurs, yielding what are thought to be α, β unsaturated ketones. Metal soaps such as cobalt stearate markedly increase the level of formation of secondary products. A definite thermal activation effect was found. JAOCS, *33*, 152 (1956).

SEPHTON and Sutton find that the autoxidation of methyl linoleate yields mainly cis-trans and trans-trans conjugated compounds, and in at least some of the cis-trans compounds the hydroperoxide is nearest the trans double bond. Separation of isomers was accomplished by partition chromatography and urea fractionation. No eleven isomer was detected. JAOCS, *33*, 263 (1956).

FRITSCH and Deatherage obtained mixed C_7-C_8 hydroxyalkyl peroxides among the volatile decomposition products from methyl oleate, oleic acid and *cis* 9-octadecene. Possible mechanisms for the formation of decomposition of these compounds are proposed. JAOCS, *33*, 109 (1956).

THE AUTOOXIDATIONS of 2,3-dimethylbutadiene and methyl 10,12-octadecadienoate follow the same kinetics. Both are auto catalytic with rates dependent on the square root of oxygen/mole of diene. The polymeric peroxides split into radicals, starting auto oxidation chains in a monomolecular manner. Various catalysts acted in the same manner. MC, *16*, 21 (1955).

THE KINETICS of the Diels-Alder reaction between trans, trans 9-11 octadecadienoic acid and diethylazodicarboxylate were studied by Gast, Bell, and Teeter. The reaction is pseudo second order and proceeds faster in polar solvent. Water increases the reaction rate, and an acid catalyst is useful in non-polar media. JAOCS, *33*, 278 (1956).

TREATMENT of fatty acids with sulfur trioxide in liquid sulfur dioxide at −10°C. produces monosulfonated products with high residual unsaturation in excellent yields. Sauls and Rueggeberg find that the surface tension goes through a minimum at pH 8 and a maximum at pH 10. JAOCS, *33*, 383 (1956).

ALLEN synthesized the first conjugated cis, cis octadecadienoate reported, methyl cis-10, cis-12 octadecadienoate. J. Org. Chem., *21*, 143 (1956).

UNSATURATED carboxylic acid polymers are formed by treatment of soybean fatty acids with boron trifluoride. After stripping the unreacted acids, a 71% yield of product containing no cross linked gel is obtained. USP 2,729, 658. Mono-olefinic acids and esters can be dimerized in the presence of 5-30 mole percent of organic peroxides to yield dimeric acids of the same degree of unsaturation as the parent compound. USP 2,731,-481.

TEETER and Cowan reviewed the viscometric properties of the higher fatty acids and their derivatives. JAOCS *33*, 153 (1956). (Correct JAOCS, *33*, 29: Hawley

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SOYA				
Water White Distilled	135 Min.	20-23	2 Max.	195-205
RO-10	124 Min.	23-29	5-6 Max.	195-205
RO-11-S	124 Min.	23-29	4 Max.	195-205
SOYA-TYPE				
RO-8	115 Min.	30 Max.	6-8	195-205
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et al, JAOCS, *33*, 29 (1956); USP 2,733,251.)

WEIL and Port prepared allyl esters of sulfonated acid salts. The polymers of these were not wetting agents, but were highly stable emulsifying agents. A 2% solution was a thixotropic, viscous solution or gel. JAOCS, *33*, 44 (1956).

KISELEV and Ermolaeva transesterified mono- and diglycerides or monoesters of dibasic acids and ethylene glycol with butyl titanate. The products converted to dry films (at 170-200°C.) which were thermostable and had good adhesion and elasticity. Zhur. Priklad, Khim, *29*, 432 (1956); CA, *50*, 9763 (1956).

HYDROXYLATED polybutadienes can be reacted with drying oil acids and oils to furnish varnishes suitable for food and beverage cans. USP 2,741,397.

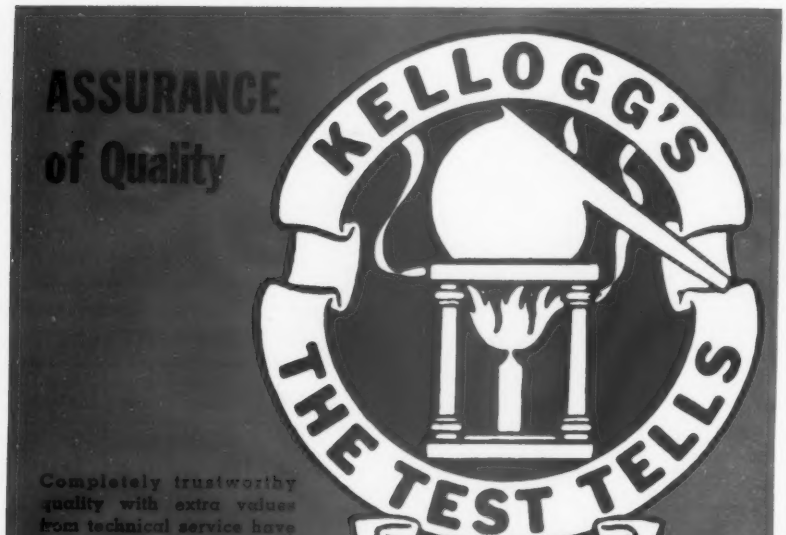
Treated Oils

THE ACETONE extractable fraction of heat bodied linseed oils drops to 31% and levels off after a Z4 body has been passed. The fraction is monomeric (MW = 950) and has an iodine value of 115. Mehta and Sharma suggest that 8-17% of the linolenic acid cyclizes, causing a large initial drop in unsaturation without increasing the molecular weight. JAOCS, *33*, 38 (1956).

THE SYNTHESIS and purification of fatty acids by the pyrolysis of esters is described by Bailey and Turek. The method is usually clean, very rapid, and is a preferred method for water soluble acids. JAOCS, *33*, 317 (1956).

THE POLYMERIZATION of linseed oil by boron trifluoride is dependent on oil and catalyst concentration. A critical temperature exists for each combination, above which the reaction proceeds exothermically to a gelation, but below this temperature the reaction is controllable. If a concentrated catalyst solution is prepared and then diluted, a shorter gel time results. Tung oil gels around the gas inlet tube with the first bubble of catalyst. Seven percent BF_3 will gel linseed oil at room temperature within 24 hours. When linseed oil was fractionated between hexane and ethanol on alumina, the hexane portion gels slower than the control, the alcohol portion more rapidly. Low acid value, fast drying bodied oils can be prepared, but a yellow-red brown color develops during drying or heating. This disappears in a thin dry film. More monomeric and dimeric acids are found than in normal heat bodied oils. PVP, *46*, #2, 36 (1956).

TESS and Dannenberg reacted oils with 3-8% ditertiary-butyl peroxide at 135-175°C. The molecular weight increased without increasing the acidity or unsaturation of the oil and the treatment either bleached the oil or retarded color formation. Fish oil was found to have a faster drying rate, increased film hardness, improved color and odor after treatment. Peroxide treated oils have higher iodine values, lighter colors, lower viscosity and acid value, and better drying properties than heat bodied oils of equal molecular weight. Ditertiary-butylperoxide is much more efficient than tertiary-butylhydroperoxide and was the only peroxide to improve the drying rate and increase the viscosity of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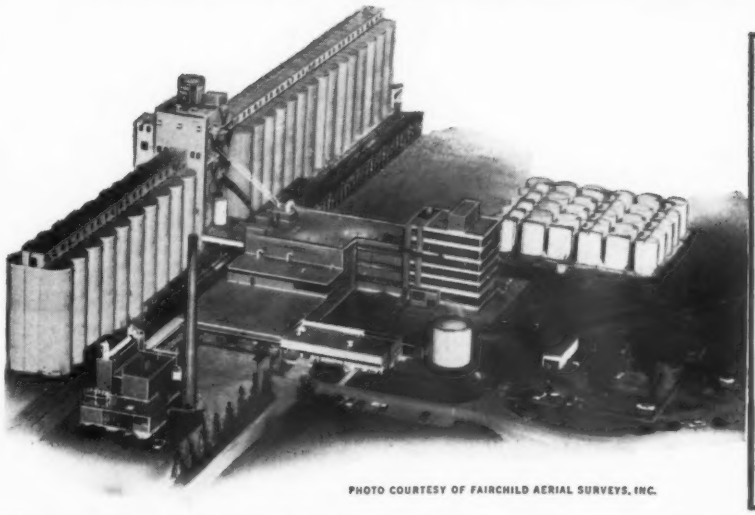

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oils. Benzoyl peroxide darkened sardine oil, but cumene hydroperoxide shows a slight bleaching action. The reaction involved appears to be a dehydrodimerization. IEC, *48*, 339 (1956).

WILBORN and Morgner followed the blowing of linseed oil. Viscosity, saponification number, density, acid number, refractive index, hydroxyl value and alcohol tolerance increased with time and temperature, while iodine value and drying time decreased. The peroxide value rose to a maximum at six hours and then decreased. Linear relationships were found between oxygen content and hydroxyl value, peroxide and hydroxyl numbers, and iodine value and viscosity. Cobalt salts produce a higher hydroxyl number and viscosity but a lower peroxide value. On storage, blown oils increase in viscosity, acid value, and hydroxyl number, but the peroxide value decreases. For quick drying finishes the authors recommend oils blown at low temperature without catalysts, so as to produce a high peroxide content. When the oil is to be used with polar film formers, a high hydroxyl value is important.

BOILING eleostearic acid results in an intermolecular Diels-Alder condensation. At 285° C., the concentration of conjugated diene goes through a maximum after the conjugated trienes have almost disappeared, suggesting the formation of additional conjugated diene by thermal isomerization. This is not noted at 250°, when an initial increase in conjugated diene accompanies a sharp decrease in conjugated diene and the iodine number remains constant. The dimer is a viscous yellow oil and the central and terminal double bonds act as dienophiles to an equal extent. No trimers or bicyclic compounds were found. Maschka and Muller found that the reaction is second order and that the acid reacts twice as fast as the methyl ester. Monatsch, *86*, 397 (1955).

SLANSKY maleated various drying oils. Blown oils tend to gel on storage with even small amounts of maleic. Esterifying the adduct of a boiled oil with a monohydric alcohol leads to a poor film former, but glycerine produces a product with faster varnish processing time and better color than an untreated oil, although the dry and water resistance is not improved. No throwout occurs with lead driers. By heating linseed oil and polyols to 280° C. adding maleic and holding until esterification is complete, an oil with good dry, water resistance, no after tack and good non-yellowing properties is obtained. Fumaric acid is similar to maleic, but a drier throughout comparable to the untreated oil can occur. PM, *26*, 155 (1956).

HEAT bodying of linseed oil at 288°C. with 1% polyethylene (2000-4000 MW) yields high viscosity materials in a short time. The oils have superior water resistance and show less tendency to skin than normal or catalytically bodied oils. USP 2,739,975.

PETIT analyzed a linseed oil which had been bodied for 54 hours at 280° and found 52.8% C_{18} monoacids, 30.5% C_{36} diacids, 13.7% C_{54} triacids, and 3% oxidized C_{54} triacids. Separation was accomplished by hydrolysis, esterification with ethanol, distillation, and chromatography on alumina with hexane. CA, *50*, 9035 (1956).

VON MIKUSH and Bush reviewed APJ, *40*, #46, #48, #50, #51, #52; *41*, #1 (1956).
PIM, *71*, #6,8 (1956).

HOEVE applied Flory's polycondensation equations to polymerized oils, as a random distribution was shown to occur because of ester interchange at bodying temperatures. Flory's theory was extended in simple cases to include ring formation effects. Theoretical calculations agree well with the published data of Pashke and Wheeler. JPS, *21*, 1, 11 (1956); JAOCS, *33*, 312 (1956).

ANGELINI discussed the kinetics and mechanism of the polymerization of drying oils. Without oxygen or other catalysts, elaidinisation may take place in the early slow stage leading to cloudiness and cracking, as unsaturated, resinifiable products appear in the distillate. Pitture e Vernici, *9*, 699 (1955).

THE CYCLIC derivatives from heated oils and fatty acids have been investigated by several researchers. Rivett cyclized methyl-β-eleostearate at low heat and indicated from spectroscopic data that 1,2-dialkyl-3,5-cyclohexadiene is the probable primary product. Floyd, *et al*, heated methyl linoleate with a palladium-charcoal catalyst to less than 2% linoleate, with 7% polymer, 18% methyl stearate, 40% mono-olefins, and 30% of a methyl ester of an aromatic fatty acid which was readily oxidizable to phthalic anhydride. MacDonald ethanolized a 306 cs. linseed oil and fractionated the products. 12% of the mixture did not form a urea adduct as isolated nor when hydrogenated. It showed a characteristic absorption at 15.2 microns, and when aromatized by treatment with N-bromo succinimide followed by dehydrohalogenation could be oxidized to phthalic anhydride. JAOCS, *33*, 635, 609, 394 (1956).

ALLEN and Kiess report that stepwise addition of two moles of hydrogen to methyl eleostearate yields equimolar amounts of 9,10,11,12 and 13-octadecenoates. JAOCS, *33*, 419 (1956).

Transesterification

A CONCENTRATED monoglyceride product can be obtained by extracting an alcoholysis mixture with methanol containing less than 10% water and treatment of the extract with methanol containing 30-60% water. USP 2,727,913. Vela and Roncero increased the concentration of monoglyceride from 50 to 80% by treatment of the mixture with urea. The unsaturation in the residue is also increased. Grasas y Aceites, *6*, 230 (1955).

THE THEORETICAL aspects of the manufacture of monoglycerides were examined by Demarq. Tertiary butyl alcohol is the most practical solvent, although pyridine is slightly more efficient, while diacetone-alcohol is unstable. Poor agreement with previously published data is reported. Rev. franc. corps gras, *3*, 336 (1956).

AYLWARD and Wood have studied urea adducts of alcoholysis products. Methanolysis occurs during prolonged urea adduct crystallation. Adducts are formed with both glyceryl monostearin and distearin and the latter is preferentially precipitated. During adduct formation, 2-monopalmitin is partially converted to the 1-isomer. Chem and Ind. *1955*, 1479; *1956*, 53; Nature, *177*, 146 (1956).

OF THE NITROGEN oxides, only NO_2 is an effective catalyst for the conversion of cis to trans unsaturated fatty acid esters. Kahn converted methyl oleate to the elaidate and methyl linolenate to the trans modification which then polymerized. J. Chem. Phys. *23*, 2447 (1955).

ALUMINUM alcoholates reduce the oxygen uptake and volatile loss during film formation with oxidized linseed oil, according to Schlenker. FL, *62*, 9 (1956).

SOME preliminary results of the irradiation of tung oil are reported by Greenfield. Exposure to gamma rays from a pile or in an electron beam decreases the total eleostearic content and causes alpha to beta isomerization. Continued exposure beyond eight megareps causes the sample to become cloudy, insoluble in mineral spirits, and then go through a paste, rubber, and finally plastic stage. Cold cut 15 gallon estergum varnishes from 8 megarep oil dry tack free in one hour, are gas proof, and pass three hour immersion in 3% caustic. Am. Tung Oil Topics, *2*, #1 (1956).

TUNG OIL is readily isomerized by alkyl iodides and will solidify in the beta form within five days. USP 2,744,213.

CASTOR OIL can be dehydrated by sulfur dioxide at 280°C. The gas acts as catalyst, decolorizer, and mechanical stirring agent. French Patent 992,192.

A 30-40% yield of conjugated acids is attained by treatment of unsaturated acids with N-bromosuccinimide and thermal dehydrobromination of the product. Chem. and Ind., *1956*, #3, 82.

ENRICHMENT of mixtures to 60-80% monoglyceride content is possible by a single urea treatment, but the affinity of monoglycerides for urea only slightly exceeds that of the diglycerides and notable quantities of triglycerides are embodied in the complexes. Olearia, *9*, 247 (1955).

SIGWALT discusses the evidence for and against the Scheiber-Kappelmeier mechanism for thermal polymerization and ascribes the evidence against the theory to inaccuracies in analytical methods. Bull. Soc. Chim. France, *1955*, 1643.

Copolymers

A WEATHER resistant, strippable paint can be made from a copolymer of styrene and castor oil. By applying a secondary coat of a resin and solvent, the adhesion of the first coat is destroyed, while a radioactive contaminant is sealed between the two coats. BP 740,980.

CLEAR, haze-free coatings are claimed from a mixture of linseed oil or modified alkyds and an interpolymer of a styrene monomer with up to 10% of a drying oil in the presence of a boron halide catalyst. USP 2,731,430. Viscous materials useful as coatings can be prepared by treating drying oils or alkyds with styrene vapors at 200-300°C. Liquid styrene must be avoided and the gas should be diluted with nitrogen. The clear products range from 300-6000 poises after a four hour reaction period. Dutch Patent 77,877.

VINYL copolymerizations with drying oils proceed rapidly to soluble products when small amounts of isothiocyanates (or compounds which produce them on heating) are included in the formulation. German Patent 923,391.

VINYL ESTERS of linseed fatty acids have been synthesized by reaction with acetylene at 210°C. under atmospheric pressure with 3% zinc oxide catalyst. A polymerized oil of 172 poises was obtained by heating with 2% benzoyl peroxide and dried in four hours at 75% humidity with ordinary driers. J. Japan Oil Chemists Soc., *5*, 11 (1956); CA, *50*, 11029 (1956).

THE MAJOR product from the reaction of gaseous styrene with methyl linoleate at 280°C. is a Diels-Alder adduct. Tiong and Waterman found no high molecular weight polystyrene formed. J. Appl. Chem., 6,197 (1956).

THE MONOESTERS of sucrose can be prepared by treatment of 3 moles of sucrose with one mole of methyl ester in dimethyl formamide or dimethyl sulfoxide with an alkaline catalyst. Osipow, *et al*, who studied the surface activity of the products, claim that the mono and diesters are initially formed in equal amounts, followed by increasing conversion to the monoester. IEC, *48*, 1459, 1462 (1956).

TEETER, *et al*, prepared vinyl ethers in 85% yield by reacting fatty alcohols, potassium hydroxide, and acetylene at 180°C. The compounds polymerize to low molecular weight (670-5000) products with ionic catalysts. Boron trifluoride produces viscous colorless liquids (with unsaturated ethers) which dry at 150° with a cobalt catalyst. JAOCS, *33*, 399 (1956).

HOFFMAN, *et al*, reacted acrylonitrile and fumaronitrile with eleostearates and examined the plasticizer properties of the butyl esters of the adducts. Two nitrile groups confer more permanence and compatibility to the product. The beta acid derivatives are superior to alpha derived plasticizers. Acrylonitrile adducts show better modulus and lower brittle points and are recommended as secondary plasticizers. JAOCS, *33*, 410 (1956).

BY EXPOSING tung oil to air and sunlight, extracting the solubles with benzenes and grinding the residue in dry ice, a catalyst containing several polymerization inducing radicals can be prepared. High molecular weight polystyrenes of extreme toughness and strength have been prepared by bulk polymerization at low temperatures with this catalyst. USP 2,734,893.

GREAVES discusses non-yellowing oils with emphasis on tobacco seed oil. JOCCA, *39*, 934 (1956)

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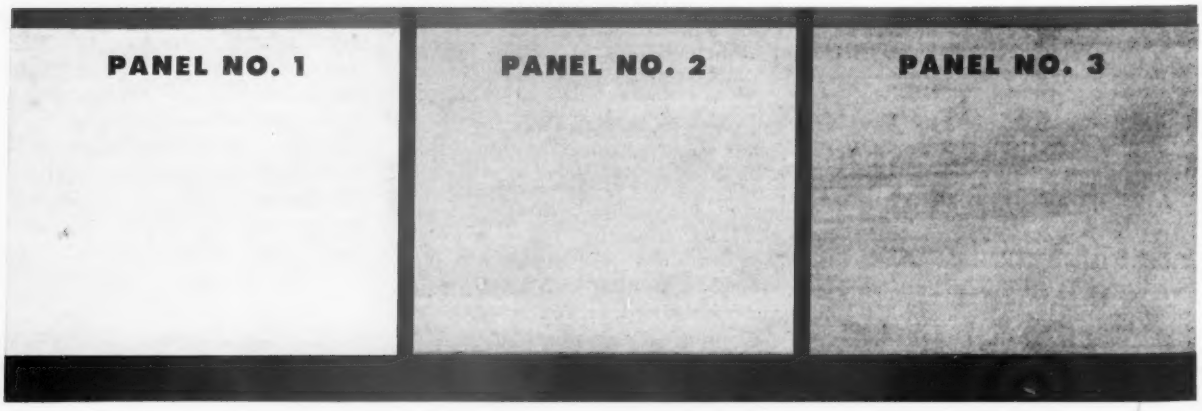

ADDITIVES AND INTERMEDIATES

ADDITIVES

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3) Aryl sulfonamides, particularly p-toluene or p-phenylenedibenzenesulfonamide. USP 2,731,433, BP 738,341.
4) Amino acids. BP 738,340.
5) Alkanolamines. BP 738,342.

Soaps and Driers

MEHROTRA and Pande describe the preparation, properties and analysis of aluminum tripalmitate, -myristate, -laurate and -valerate by reaction of aluminum isopropoxide with fatty acid. J. Inorganic and Nuclear Chem., *2*, 60 (1956).

RINSE discussed aluminum tritallate, which varies from a solid when made from high rosin tall oil to a viscous liquid when made from tall oil fatty acids. It has excellent solubility and compatibility with film formers. A rapid partial hydrolysis by water or moist oil leads to solid, water resistant products. One acylate can react with hydroxylated compounds, but the other groups can only be removed by treatment with alkali. Films can be cast from solution and dry to glossy, water resistant coatings which can be further crosslinked by the addition of driers. Solutions of tritallate will get uniformly upon the addition of 2% of emulsified water. APJ, *40*, #32, 54 (1956).

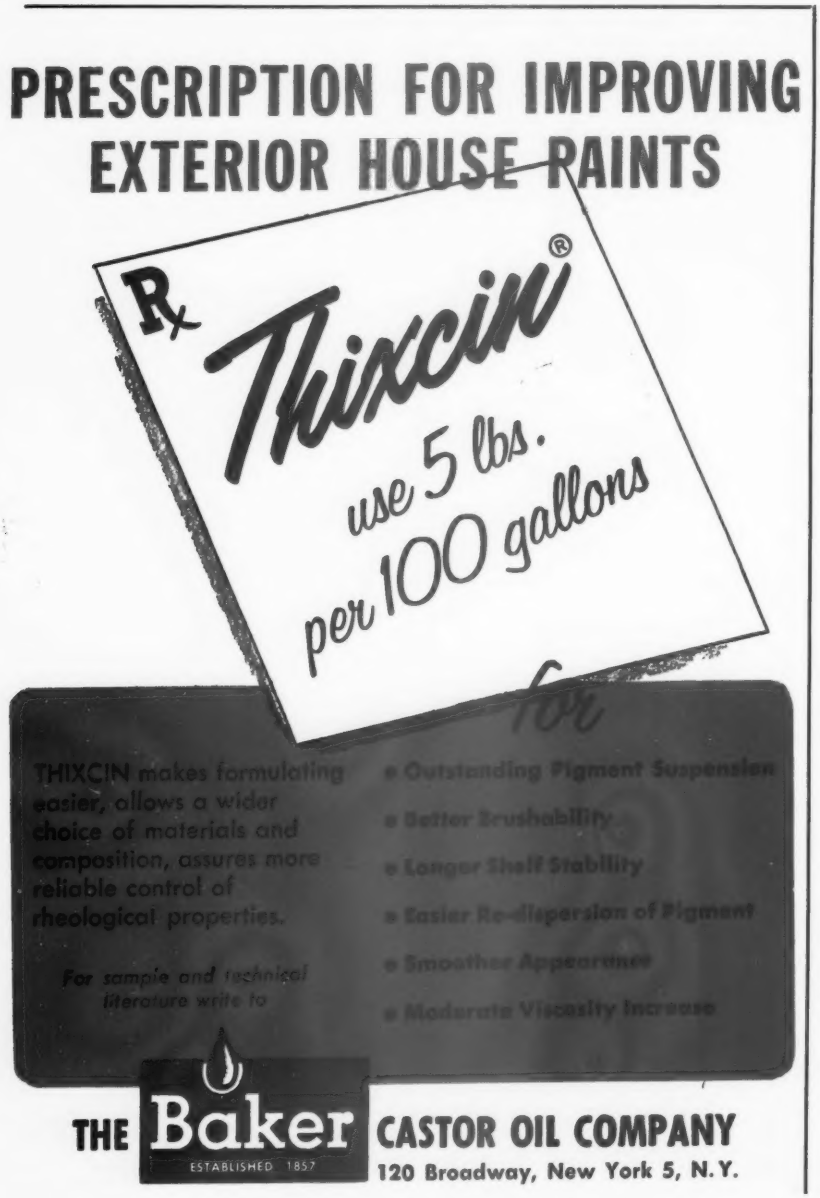
LICATA reviewed the preparation, types, and uses of aluminum soap gels. OD, *28*, 121 (1956).

AN IMPROVED synthesis of aluminum trisoaps has been reported. J. Chem. Soc. 1956, 1972.

STUMPF presented viscosity data on various metallic stearate gels in several solvents. Mono and distearates produce the strongest gels in aromatic solvents, while the lower viscosity of commercial tristearates is attributed to the presence of free stearic acid. All solutions decrease in viscosity on aging and tristearates show the most rapid breakdown. Aliphatic hydrocarbon, turpentine and linseed oil gels haze on standing with syneresis and breakdown of gel structure. Milling a stearate and solvent without applying heat produces a lower viscosity than a heat induced solution. Zinc stearate is the preferred flatting agent for varnishes as no gelation occurs. When aluminum stearate is used as a flatting agent, care must be exercised to prevent excessive gelling but aluminum soaps are widely used as suspending agents because of the large controllable variations in the nature of the gels. Calcium and magnesium stearates do not exhibit any thickening action. PM, *26*, 117 (1956).

LEAD drier concentrates can be prepared by reacting litharge with a mixture of toluic and naphthenic acids. A higher concentration of lead is achieved without interference due to the insolubility of lead toluate. USP 2,734,829. (Add to Licata: APJ, *40*, #39, 90 (1956).

ALUMINUM dilaurate-toluene gel flow properties were studied by Weber and Bauer in a pressure capillary viscometer. Newtonian flow occurs with high viscosity below shear rates of 10^{-2} sec.$^{-1}$. After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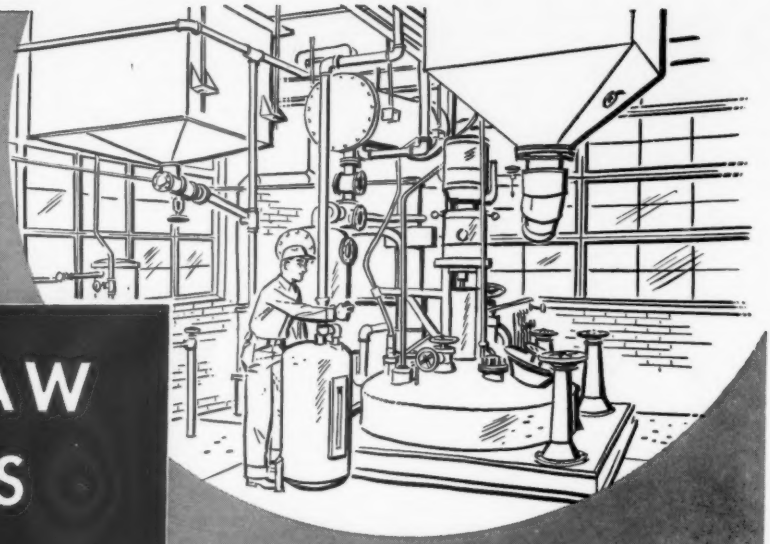

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a critical shear stress is exceeded, the rate rapidly increases with a small increase in stress. Above 100 sec.$^{-1}$, a third region occurs where a log-log plot of rate vs. shear approaches a constant slope greater than unity and the flow curve is a function of the length/radius ratio of the capillary. The shear modulus of elasticity and the viscosity were measured at low shear rates. J. Phys. Chem., *60*, 270 (1956).

ALUMINUM salts of tautomeric keto-enols mixed with oils or alkyds are reported to yield hard, wrinkle free, water resistant films. BP 740,251.

Preservatives

ALKYL thiuram sulphides are effective in aqueous emulsion paints. BP 736,965.

KLENS and Lang describe a laboratory fungicide screening test and point out that interactions must be checked in each case to determine whether any loss in either paint or antifungal properties occurs. Verfkroniek, *29*, 11 (1956). Evans and Bobalek developed an improved modification of the Hutchinson test. IEC, *48*, 122 (1956). Both papers stress the need of weathering tests in evaluating mildew resistance.

JONES, *et al*, studied commercial Canadian paints against bacteria, yeasts, and molds under laboratory and cold storage conditions. Mercury containing paints were superior to chlorinated rubber paints or paints containing copper-8-quinolinate. Higher concentrations are required at higher temperatures. CPVM, *30*, #5, 30 (1956).

ARNOLD and Clarke evaluated fifteen fungistats in emulsion paints and found tri-n-butyl tin hydroxide outstanding. Chlorinated phenols and organic mercurials were inferior, but long chain quarternary compounds deserve further study. JOCCA, *39*, 900 (1956).

THE USE of solubilized copper-8-quinolinate in fungus resistance maintenance paints was reviewed by Goldfarb. A laboratory test method which has correlated with field tests in food plants is presented. APJ, *41*, #12, 94 (1956).

A HALOACETAMIDE of the type XCH_2CONH_2 inhibits the susceptibility of paints to microorganisms. BP 732,480.

COPPER (II) hydroxide is useful in preventing the fouling of shipbottoms, when over one pound is used per gallon of coating. USP 2,738,283.

A SYMPOSIUM on surfactants appears in OD, *28*, 418 (1956). Wetting agents in solvent systems, methods of evaluating surfactants in latex paints, structure and properties of surfactants, the HLB system, and the use of surfactants in disperse systems are discussed.

Miscellaneous

BP 737,385 claims that the light fastness of colored lacquer coatings is improved by incorporating a polyurethane or its precursor.

HULT reviewed the use of lecithin in the paint industry. JOCCA, *39*, 399 (1956).

AN ABSTRACTED and cross-referenced bibliography on the deterioration of protective coatings by molds and bacteria has been published by Pfohl, *et al*, covering the period 1947-55. OD, *28*, 954 (1956).

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Miscellaneous

WHITEWAY, *et al*, tested eight anti-skinning agents at several levels in various vehicles under different conditions. The results varied widely indicating that no single compound is best for all cases. OD, *28*, 1083 (1956).

Technical Bulletins

Stearates, Their Properties and Uses—Witco Chemical Company.
Metallic Soaps—Metasap Chemical Company.

Tergitol Surfactants—Carbon and Carbide Chemical Co.
Uvinuls—Antara Chemicals.

INTERMEDIATES

SIDLOW reviewed the uses of titanium esters as cross linking agents and in heat resistant finishes. JOCCA, *39*, 415 (1956).

PULLMAN discussed acrylonitrile. As a comonomer, it increases hardness, toughness, solvent resistance, drying time, and viscosity characteristics of resins. Formulations are given for solvent copolymerization and useful chemical derivatives, and a theoretical basis for experimental conditions is discussed. PVP, *46*, #7, 27 (1956).

MONO OLEFINS have been added to dienophiles at high temperatures under pressure by Albisetti, *et al*. Water prevents the formation of tars when acrylonitrile is used. The double bond appears in the $\delta,_{\epsilon}$ position of the product, in accordance with the cyclic mechanism proposed by Arnold. JACS, *78*, 2637 (1956).

THE CHEMISTRY and possible use of levulinic acid and its derivatives are listed in an extensive review article by Leonard. The acid is a potentially readily available chemical from agricultural sources. IEC, *48*, 1330 (1956).

CROWLEY and Vance described isobutyl alcohol and its esters in coatings. As a solvent, it usually shows higher viscosities than corresponding solutions in normal butanol. Phthalate and acetate derivatives as solvents and plasticizers are evaluated. PM, *26*, 333 (1956).

ALLSEBROOK reviewed the raw materials used to manufacture odorless paints. PM, *26*, 371 (1956).

Technical Bulletins

Glycerine—Terms, Tests, Technical Data—Glycerine Producers Assoc.

Glycerine Properties and Uses—Glycerine Prod. Assoc.

Phosphonitrilic Chloride—Millmaster Chem. Co.

Paraformaldehyde—Heyden Chemical Corp.

Propylene (SD-59)—Manufacturing Chemists' Association.

Ethers and Oxides—Carbide and Carbon Chem. Co.

Ethanolamines—Allied Chemical and Dye Corp.

Chemical Safety Data Sheet SD-53, Hydrogen Peroxide—Manufacturing Chemists' Association.

Monopentek; Dipentek—Heyden Chemical Corp.

Chemicals for Latex Resin Emulsions—Carbide & Carbon Chem. Co.

Epichlorohydrin—Carbide & Carbon Chemical Co.

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APPLICATION METHODS

ARCHITECTURAL COATINGS

WERTHAN describes attempts to correlate basic physical properties with actual performance, and concludes that tensile strength and elongation tests are not significant or informative by themselves. He shows how problems can be solved by different methods, such as formulating for blister resistance by using high moisture permeable films (latices) or films which are less permeable, but show strong adherence under moist conditions (alkyds). Oils, alkyds, polyvinyl-acetate, butadiene-styrene and acrylics in interior and exterior formulations are compared. OD, *28*, 186 (1956).

HUFFMAN reviewed the use of styrene-butadiene latex paints for exterior masonry surfaces. APJ, *40*, #20, 78 (1956).

GORDON discussed the formulation, preparation and evaluation of polyvinyl acetate paints. OD, *28*, 146 (1956).

MINUCCIANI reported on the exposure characteristics of latex paints over stucco. OD, *28*, 816 (1956).

DEVELOPMENTS in oil type exterior house paints were discussed by Vannoy. Rutile TiO_2 should be used for best resistance to checking, cracking, flaking and erosion. A combination of acicular zinc oxide and calcium carbonate is better than leaded zinc oxide and use of a selected calcium carbonate allows a marked reduction in zinc oxide content. The best all purpose tint base was made from rutile and calcium carbonate at a suitable zinc oxide level. Tint retention is improved by replacing magnesium silicate by calcium carbonate. Iron oxide pigments show good resistance to fading but provide dull colors. No completely satisfactory mildew inhibitor has yet been found. APJ, *40*, #26, 16; #27, 76; #30, 80 (1956).

LILLEY points out that good stain and blister resistant exterior house paints can be made from alkyds when alkaline constituents are omitted from the formula as the pH must be kept below the critical value of 5.0, above which iron and copper will precipitate. Calcium carbonate confers good mildew and erosion resistance to alkyd paints but suffers severe staining, whereas magnesium silicate is relatively non-staining. Tint retention improves as the pigment volume is lowered. Mildew control varies greatly with the type of pigment used. Repainting where a bad moisture condition exists and where zinc oxide has previously been used requires complete removal of the old film. PIM, *71*, #3, 15 (1956).

FREMGEN, *et al*, studied the influence of free binder on the color uniformity of flat masonry paints. A minimum of prime pigment and a maximum level of natural calcium carbonate gives close pigment packing and permits integration of other necessary extenders. Mica enhances application properties and helps prevent settling. Diatomaceous silica should be included to eliminate sheen. Overgrinding should be avoided and actual optical performance is a better criterion to use than the fineness gauge for this type of paint. OD, *28*, 256 (1956).

TOELDTE prepared a two dimensional scale standard sample to evaluate the yellowing of white paints. The yellowing of linseed oil paints in the dark was studied by several workers. Removing tocopherol chromatographically reduced the rate of yellowing, but bleaching the linseed oil with activated earths increases after yellowing. Yellowing increases with pigments in the order titanium dioxide, zinc oxide, lithopone. Zinc oxide reduces the yellowing tendency of lithopone based paints. FATIPEC Congress Proc. *3*, 83, 209, 225 (1956).

BRUNT theorizes that loss of gloss on weathering is an effect of microcracking caused by dust and sand collision with paint surfaces, and a low modulus of elasticity and high tensile strength favors gloss reten-

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tion. Dirt retention is caused by mechanical effects occurring when the material shows retarded elasticity in a time range longer than the time of collision. FATIPEC Congress Proc., *3*, 195 (1955).

CHALKING is partly dependent on the incomplete dehydration of hydroxides during the manufacture of titanium dioxide according to Petit. FATIPEC Congress Proc., *3*, 251 (1956).

WIRTH studied the permeability and blistering of typical exterior house paints and found no correlation between the two. In blister box tests a lead-free paint, a standard house paint, and a very long oil alkyd showed a high degree of blistering, while an acrylic emulsion and a chlorinated paraffin based paint showed none. The acrylic tended to show bleed through. Vertical grain panels exhibited much less blistering than flat sawn Eastern pine. APJ, *40*, #35, 72 (1956).

KNUTESON, *et al*, report that none of the extender pigments adversely affect the blister resistance of house paints. Calcium based extenders tend to check but show good color retention and crack resistance. Coarse magnesium silicate and mica have poorer color retention but are excellent in other properties. As the PV is increased, cracking and chalking increase while checking and color retention decrease. The weatherometer cannot be used to determine stain resistance. OD, *28*, 1078 (1956).

SANDERMAN and Schwarz examined the effects of different wood substrates on drying and weathering of several coatings. Drying was strongly inhibited over oak, redwood, or iroko and initially slowed by pine. A white paint cracked and blistered over spruce, exhibited rosin exudate from pine, blisters over the rings of redwood, blistering and discoloration over iroko and peeling over oak. The last two effects disappeared when the woods were extracted with ethanol-benzene. A polyester resin was affected the worst with poor dry followed by severe peeling over iroko, redwood and rosewood, although no damage occurred with extracted woods. Extracts from pine and redwood added to linseed oil mildly inhibited the dry, but oak and iroko extracts showed considerable inhibition. Etherification of the phenols in the extracts destroyed the inhibiting action. Extraction of rosewood leads to at least five acid inhibitors, two of which are phenolic. FL, *62*, 134 (1956).

WATER penetration was studied by Pragst, using a methylene blue solution. Pigmentation by white or red lead reduced the water resistance, and the penetration followed brush marks (thinnest portion of the film) indicating that good flow properties enhance the protective value of the paint. FL, *62*, 145 (1956).

FLATTING of enamels has been attributed to pigment migration produced by differences in density or by streams of liquid during solvent evaporation. Lecithin, zinc naphthenate, silicones, and surfactants are recommended additives to the mill base to prevent this phenomenon. Pitture e Vernici, *12*, 105 (1956).

STEIG claims that much of the penetration and non-uniformity of color over different surfaces shown by flat alkyd paints is due to pigmentation above the critical pigment volume, and the CPVC does not vary with the vehicle as it de-

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pends only on the void space and not on the molecular weight. Oil absorption can be correlated with CPVC. In simple test paints, excellent color uniformity was found in a narrow range of 3% below the CPVC curve. By using standard curves the optimum level of pigmentation can be determined. OD, *28*, 695 (1956).

A PRELIMINARY survey of exterior exposure characteristics of clear finishes for wood was made by Estrada, *et al.* Results vary widely for different locations. A first coat of stain is most effective in promoting durability, and the necessity of an adequate film thickness is evident. Silicone resins are undesirable and modified epoxy resins are poor. A cyclopentadiene modified oil is standing up well and the alkyd resins show the most promise, although they tend to sheet peel. Mildewcides are effective, but can introduce poor side effects. OD, *28*, 1001 (1956).

THE BLACKENING effect of hydrogen sulfide on exterior house paints was studied by Ward, *et al*, who reach the following conclusions:

1) Normal amounts of lead drier will not produce darkening.
2) The concentration of hydrogen sulfide is not critical.
3) The degree of blackening varies directly with the lead content.
4) Blackening is delayed if the film is glossy and unweathered. A high pigmentation darkens more readily.
5) No blackening occurs unless the film is actually wet with water.

THE ONE ALKYD paint included in the series tended to be more susceptible to attack than the oil paints. OD, *28*, 1089 (1956).

ACCORDING to Crippen, *et al*, the higher the ratio of antimony oxide to organic chloride, the better the fire retardant properties of the paint. Barium sulfate gave erratic results, but zinc borate and urea-formaldehyde resins were ineffective in fire retardant formulations. OD, *28*, 942 (1956).

MUKHERJEA and Hamann studied the blooming of varnish films. Only varnishes which were not gas proof bloomed at high humidity. Free glycerine leads to an uneven surface and a cratered film at high humidity, but the use of calcium drier minimizes this effect. An ammoniacal atmosphere is the worst cause of blooming, especially when free fatty acids are present. The use of an excess of lead drier should be avoided. Hydrogen sulfide causes films to become soft and tacky but does not cause bloom. Ammonium sulfate precipitated on the film by gaseous reagents causes yellowing, softening, and loss of gloss, but not blooming. The authors recommend the use of 0.1% calcium to reduce bloom, softening and yellowing, and postulate that the calcium stabilizes any ammonium salts of fatty acids or resinates in a fine and uniform dispersion, preventing their precipitation on the surface. PM, *26*, 449 (1956).

THE MATTIELLO Lecture was given by Van Loo, who reviewed several physical-chemical aspects of paint coatings including vortex action, critical pigment volume concepts, and ultraviolet absorption and its relation to durability. OD, *28*, 1126 (1956).

INDUSTRIAL COATINGS

BRAND, *et al*, evaluated organic coatings for use in cathodically protected domestic hot water tanks and found that blistering does not affect the electrical conductance, but that failure is caused by loss of adhesion. Alkali resistance and water permeability are important. Butadiene-styrene films tend to fail from thermal shock, but epoxy-phenolics showed up well. PVP, *46*, #1, 25 (1946).

ELM reviewed basic principles and previous work on conductive coatings for use with cathodic protection. PVP, *46*, #9, 27 (1956).

JAMES studies the adhesion between primers and finish coats in boot-top and topside marine finishes. Tests were conducted by sandwiching wet filter paper between two films, aging in a bell jar, and testing with adhesive tape. The primer medium is more important than the pigmentation, but paints are superior to clear finishes. Alkyds, oils, varnishes, styrenated oils and epoxy primers all showed good adhesion when finished after this period. Washing the surface does not improve adhesion to an inferior primer, but rubbing the surface does. On further aging, the primer again shows poor adhesion. Adhesion could not be correlated with permeability or water absorption of the finish coats, but there was some correlation with the water contact angle; a high contact angle, indicating poorer wetting by water, usually indicated better adhesion of a finish coat. Poor adhesion could not be cured by changing the solvents or including wetting agents or amines. Any loss of adhesion due to contact with water is regained after drying. In general, oil primers showed good adhesion, oleoresinous varnishes poor adhesion, and alkyds and epoxy esters varied considerably, with the latter showing a large dependence on the pigmentation. JOCCA, *39*, 39 (1956).

SINGER presented typical formulations for paper, metal, and automotive lacquers and discussed high solids and hot spray lacquers for furniture and metals. APJ, *40*, #20, 92; #24, 88 (1956).

LAIN published an extensive discussion of current practices in wood finishes and wood finishing. JOCCA, *39*, 670 (1956). Sloan did the same for the linoleum industry. JOCCA, *39*, 733 (1956).

A SMALL amount of alkali metal dichromate and alkali metal permanganate is claimed to inhibit corrosion and chalking in automobile finishes. USP 2,731,354.

WASSERMAN traced modern trends in wax formulation, with emphasis on the use of Fischer-Tropsch waxes in self polishing floor compositions. PVP, *46*, #9, 36 (1956). Fast drying coatings of nitrocellulose and chlorinated rubber for military, transportation, machinery enamels and fire retardant paints were reviewed by Bracken, *et al.* OD, *28*, 794 (1956)

A POLYMETHYLMETHACRYLATE solution in diacetone alcohol-methyl cellulose is recommended as a protective coating for polystyrene used under exterior exposure. Clear films require an ultraviolet screening agent, and Snyder, *et al*, suggest the incorporation of wetting agents for carbon black or aluminum pigments. MP, *33*, #10, 252 (1956).

SUMMER briefly describes the effect of ultraviolet light on metals and non-metals. Transparent varieties of methyl methacrylate, polyethylene and urea-formaldehyde are particularly sensitive, while polyvinyl chloride and Neoprene are fairly stable. Ultraviolet tends to increase the white content of a paint by bleaching the pigment. Corrosion Tech, *3*, #1, 31 (1956).

BALLENTINE, *et al*, in a study of anti-fouling paints, found that an increased pigment surface area produced by prolonged grinding does not lead to an increase in leaching. Ind. Finishing, *9*, 487 (1956). Antifouling paint progress was reviewed by Kingcome. PM, *26*, 147, 206 (1956).

PHILLIPS discussed lacquer requirements for plastics. PVP, *46*, #8, 27 (1956).

RICE studied the varnishing characteristics of coating clays and pigments used in paper products. Fine particle domestic clays have a high resistance to varnishing. White pigments show a more gradual decrease in the brightness and gloss of overprint varnishes than do clays when the adhesive content of the paper is increased. TAPPI, *39*, 43 (1956).

SPRAYABLE paints containing metallic pigments which tend to agglomerate can be stabilized by incorporating fluorochloromethanes, according to USP 2,736,665.

CRECELIUS tested various alkyd resins used in combination with vinyl resins for ship topside coatings. Maximum corrosion resistance for glycerol products is shown at the 28-30% phthalic level and few differences can be found between different fatty acids. Pentaerythritol resins are best at the 24% level. Sorbitol-glycerol combinations performed as well as straight glycerol resins with 26% phthalic, but combinations of pentaerythritol with glycerine or ethylene glycol show relatively poor performance, as do epon resins. Salt spray tests did not always correlate with atmospheric exposures. Naval Research Laboratory, PB.

BY INCLUDING melamine resins in nitrocellulose automobile lacquers, a higher total solids can be used and increased gloss and gloss retention is found. Hensley states that a 20% melamine content is optimum. When a high ratio of resin/nitrocellulose is used, spot repair is poor. OD, *28*, #379(2), 35 (1956).

AN APPARATUS to measure the rotary force needed to twist an ice block from a finish was designed by Rolle and Barnes for an investigation of deicing lacquers for stationary aircraft.

ONLY ACRYLIC ester rubbers, polytetrafluorethylene and silicone rubbers withstood 500°F. for 30 minutes in tests for a heat and rain-erosion resistant coating for aircraft. Jeffries found that the halogenated polymer was eroded rapidly by water droplets at high speed. Neither of the rubbers match the erosion resistance of neoprene, but afford a fair degree of protection. The most promising acrylic was a copolymer of 95% ethyl acrylate with 5% chloroethyl vinyl ether. U.S. Wright Air Dev. Centre Tech. Report 53-511; ASTIA Document #56535 (1954).

MICROCRYSTALLINE wax, tricresyl phosphate, and silicones added to nitrocellulose-alkyd combinations reduced ice adhesion considerably, but addition of a vinyl acetate resin to the formula showed the most promise. OD, *28*, #379(2), 56 (1956). Falkowitz and Piech used a Krouse Flexure Fatigue apparatus to test aircraft lacquers at low temperatures and showed that coatings are subject to cumulative stress effects (film fatigue) as are metals. They recommend a higher viscosity nitrocellulose and substitution of a longer oil castor alkyd for the short coconut alkyd required in present specification coatings.

KRONSTEIN and Kummerle used a multilayer system to determine the surface availability of chromate inhibitors. By applying an indicating film of mercury (I) nitrate on clear plastic, covering it with a clear lacquer, applying a film containing chromate, protecting this with another clear coat and immersing the system in water, migration of the chromate could be noted by measuring the discoloration. The movement of inhibitor pigment depended on the solubility of the chromate used, and in a phenolic system there is little migration of chromate to the substratum. PVP, *46*, #13, 37 (1956).

THE MECHANISM of wash primer action was studied by Kruger and Bloom. The primer generates a protective oxide film, supplies chromate to repair any damage, applies a zinc phosphate film analogous to the phosphate treatment of steel, and superimposes on these an organic film for mechanical protection and a good bonding surface for subsequent paint films. IEC, *48*, 1354 (1956).

AN ANTI-CONDENSATION coating can be made from a water-in-oil emulsion containing an organic film forming binder and 10-40% of a cellular material of low conductivity (preferably diatomite) dispersed in it. BP 750,137.

STRIPPABLE coatings are prepared from plasticized polyvinylbutyral dispersed in water by mahogany sulfonates. A stripping agent, such as lecithin, may be included. BP 751,270.

CHILVER outlined the problems of blistering as encountered on telescopic gasholders, where it usually occurs between the primer and undercoat. Calcium plumbate and other lead pigments in the undercoat mitigate blistering. Osmotic effects are present, but there is no evidence for electroendosm sis. JOCCA, *39*, 912 (1956).

FACTORS in the formulation of fire retardant coatings for preserved timbers were discussed by

Coburn and Morris, who studied various treated woods in a fire test chamber. Weight loss, temperatures at different depths and evaporation losses for different treatments vary so widely that the information cannot be handled on a general basis, and a coating must be studied in its relationship to a particular treatment. OD, *28*, 1245 (1956).

SPECIALTY and novelty finishes were described by Burrell (Org. Finishing, *17*, #1, 16 (1956), Allsebrook (PM, *26*, 73 (1956)), and Singer (APJ, *40*, #31, 74; #34, 72 (1956)).

Technical Bulletins

A Guide to Better Automotive Refinishing—Martin-Senour Paint Co.

APPLICATION

KRONSTEIN and Kapfer studied the effect of impact tests on the life of paint systems over metal phosphate treatments on steel and developed an electrographic print method to record damages to films. Relatively minor local damage from impact can be more serious than is indicated by impact tests, as moisture can spread under the film. A much smaller coating weight of iron phosphate can offer as good protection as a heavier zinc phosphate, but only one of the three proprietary iron phosphate treatments was equal to the zinc compound. PVP, *46*, #4, 33 (1956).

THE RELATIVE efficiencies of a number of chlorinated solvents and binary solutions as non-flammable paint strippers were reported by Berkely, Schoenholz, and Sheehy. The number of chlorine atoms per mole, chain length, and configuration are factors in determining the stripping power. The most efficient, methylene chloride, was tested in various combinations over twenty-six types of coatings. Polar solvents in small amounts improve the stripping time, but in large quantities act as diluents of the active solvent, as do non-polar solvents. Methanol was the most effective extender. Proc. Chem. Specialties Manuf. Assoc., *41*, 29 (May 1955).

AN IMPROVED synthetic resin stripping composition is made from 2,4 pentanedione, formic acid or its derivatives, water, and diacetone-alcohol as coupling solvent. USP 2,737,465.

BRUSH marks in systems of a single prime coat and single top coat can cause premature rusting by water penetration into the primer according to Buser. Spraying is preferable in humid weather over porous and wet iron. Brushing is usually superior because it allows better paint penetration into grooves and pores, does not weaken the paint by over thinning, and reduces the susceptibility of the substrate to moisture. Werkstoffe u. Korrosion, *6*, 281 (1955).

CURRENT methods for paint application and drying of finishes were reviewed by Stordy and Appleton. JOCCA, *39*, 565 (1956). Fornwell described the DeVilbiss apparatus for controlled temperature (hot spray) application of lacquers. OD, *28*, #379(2), 20 (1956).

Technical Bulletins

Red Lead Technical Letter #11—Recommended Surface Preparation of Steel for Red Lead Paints—Lead Industries Assoc.

Recommendations for Preservation of Wood in Building Construction—Protective Products Mfg. Co.

How to Paint with a Sprayer—Burgess Vibrocrafters, Inc.

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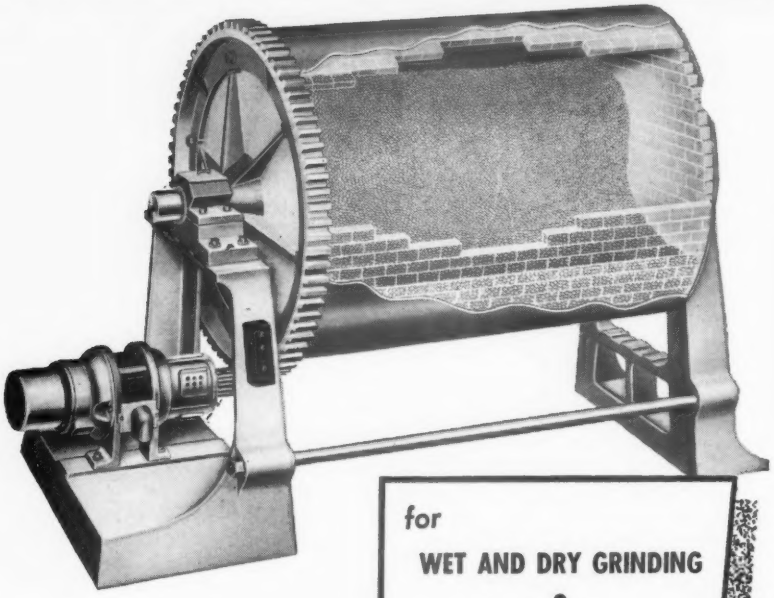

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A DIFFERENT method of paint manufacture is described in BP 736,590. Pigments are suspended and classified in a gas stream, aggregated by a spray of wetting liquid, collected, and the pigment aggregates then mixed with the paint vehicle.

A TURBO-DISPERSER for paints has been discussed. Instead of applying pressure to crush pigment agglomerates, fragmentation by rapid strokes occurs. An analogy between pigment dispersion and emulsion manufacture is drawn and the desirability of adding the pigment at high concentration is shown. PPV, *32*, 58 (1956). A gyratory vertical axis ball mill driven through an eccentric bottom bearing has 4-7 times greater capacity than usual and can be used for wet or dry grinding for either batch or continuous operation, according to Cronan. Chem. Eng. *62*, #12, 252 (1955).

HUMMEL presented some mathematical considerations of roller mill operation. JOCCA, *39*, 777 (1956).

REESE discussed the use of artificial lighting for color matching. PVP, *46*, #5, 32 (1956). Williams described modern methods of instrumental weighing and control through various phases of plant operation, such as load sensing, indicating, controlling operating sequences and remote operation, stressing the versatility of automatic systems. PVP, *46*, #5, 35 (1956).

THOMAS treated instrumentation for thickness, temperature, pH, and level controllers. PM, *26*, 377 (1956).

AUTOMATIC viscosity control instruments for the production of non-Newtonian liquids were described by Barker. Brit. Chem. Eng., *1*, 16 (1956).

A MAGNETOSTRICTIVE oscillator was used by Damerell to disperse Bentones. Thickening of the solutions was dependent on the time and amount of gelling agent present, but varied inversely with the volume present. The method worked best with oils having a high dielectric constant, but

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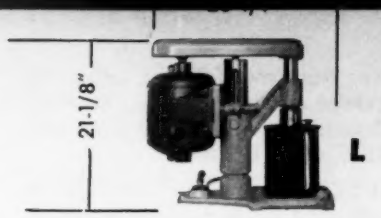

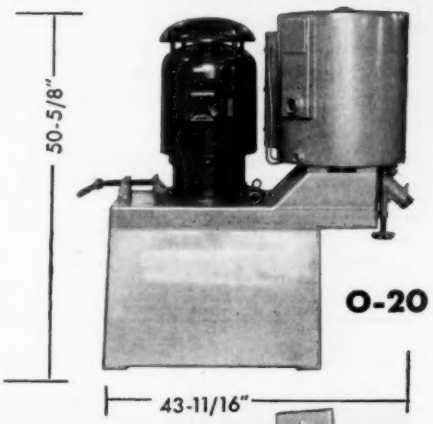

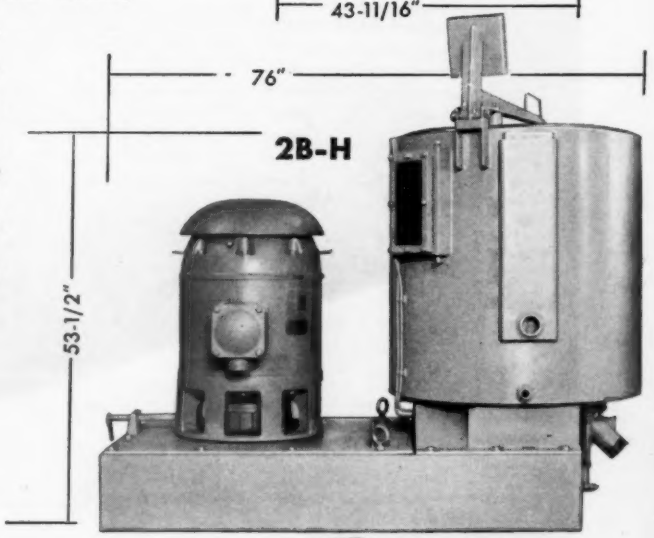

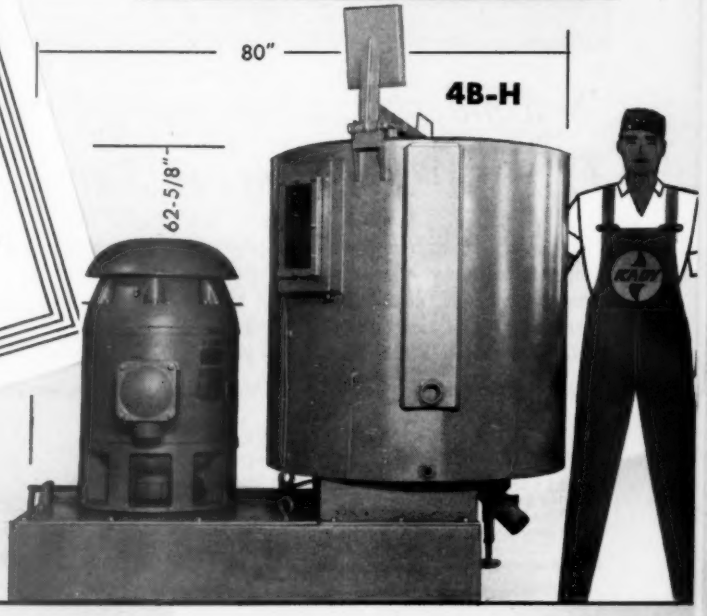

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was less powerful than other dispersion methods, such as a tri-homo disperser or a three roll paint mill. IEC, *48*, 321 (1956).

A SERIES of twenty three papers appeared in the Proceedings of the FATIPEC Congress, *3*, (1955) on the subject of color. Color matching, measuring devices, color systems, presevation of standards, psychology, and other related topics were discussed.

WESTGATE discussed the use of instruments for color matching in production control, including a review of color theory and suggested modifications to the color matching instrument. PIM, *71*, #4, 37 (1956).

A SYMPOSIUM was held on the practical applications of colorimetry in development and control. Various authors explained the GE spectrophotometer, the Gardner Color Difference Meter, the IDL Color Eye, the Davis-Bruning colorimeter, the Colormaster Differential Colorimeter, and the application of the Beckman DU to paint color control. OD, *28*, 1276-1322 (1956).

HASTINGS presented the advantages of LPG as a fuel for industrial fork lift trucks. Maintenance and repair costs are lower, savings in fuel are realized, the system is fumeless, and standard gasoline engines can be converted at reasonable cost. PVP, *46*, #13, 33 (1956).

RADFORD investigated the early detection of spontaneous combustion from oily wastes. After a slow temperature rise, one of three effects is noted:

1) The system cools off.
2) A rapid rise to 200-300°C. occurs with considerable charring and the release of volatile matter followed by a cooling of the mass.
3) A continued rise to flame and a mild explosion.

3¾ oz. of boiled oil supported on 2¼ oz. of steel wool in a 4 x 4 x 3″ vented chamber rose to 68°C. in one hour and flamed in 90 minutes. Warming the sample shortened the time to reach 80°C. Linseed oils decrease in tendency to flame in the order: boiled, raw, refined, but all can flame under certain conditions. An ionization chamber smoke detector alarm system for industrial applications is fully described. PT, *20*, 317 (1956).

GRINDING ELEMENTS for tumbling mills made of hard ceramic wearing surfaces over a lead core are claimed in BP 751,458.

DANIEL investigated the influence of solvents on seeding when low solids grinds are used for fast production. The same solvent present in both the dispersion and let down causes more seeding than the use of a two solvent combination of the same solvent power. To minimize this tendency, the poorer solvent should be used in the grind. The longer the dispersion and let down stand together without mixing, the worse the seeding. Seeding is explained as pigment agglomeration caused by the loss of solvent from the dispersion by diffusion. Powerful solvents diffuse into the let down faster than slow solvents. Spreading of a dispersion in a poor solvent into a let down containing a more powerful solvent is caused by differences in surface tension. The disappearance of seeding depends on the state of

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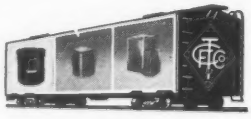

flocculation; a flocculated system redisperses easily because only a loose structure is set up, rather than a hard crystallite. Odorless mineral spirits is a good agent for the control of seeding as an aid in pigment dispersion, is effective in attaining maximum color development and controls flooding in some cases. The let down should be made in several steps with good agitation to minimize seeding. OD, *28*, 837 (1956).

Safety Bulletins

Arsenic Trioxide (SD 60); Benzene (SD-2);

Phthalic Anhydride (SD 61)—Manufacturing Chemists' Assoc.

Supervisors Safety Manual—National Safety Council.

Toluene (SD-63)—Mfg. Chem. Assoc.

Technical Bulletins

Jar Mills and Jar Rolling Mills—Paul O. Abbe, Inc.

Futura Mill—Paterson Foundry and Machine Co.

Safety with Solvents—Bureau of Mines, Circular 7757.

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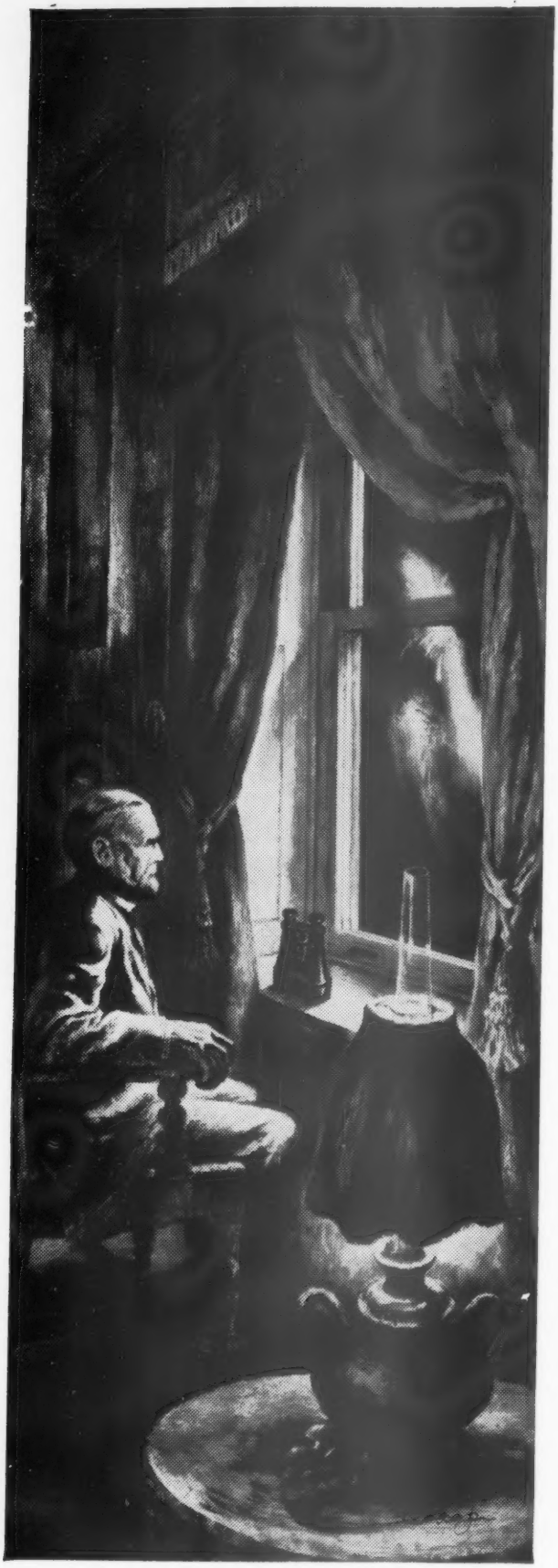

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While behind a darkened window, a big, gaunt man sat and watched, too crippled and pain-wracked to attend the opening day festivities for the bridge.

This was a pity, for he had built it.

Which means that when money gave out, Chief Engineer Roebling pleaded for more. When disturbing changes of plan had to be made, Roebling fought them through. And when a hundred panicked men were trapped under the East River in a flooded caisson, Roebling saved them.

Spinning the giant steel spiderweb not only exacted 13 years of Roebling's life, from 1870 to 1883, but very early in the game it crippled him forever with the caisson disease.

But he never gave up, saw the job through to the end. His were the courage, skill and vision that make Americans a nation of great builders—a strong, growing nation. And a nation whose Savings Bonds rank with the world's finest investments.

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CHEMICAL METHODS

ANALYSIS

TESTING

CHEMICAL METHODS

COPOLYMERIZATION of an oil or alkyd with styrene or other monomer can be achieved by rapidly recirculating the mixture through an elongated narrow zone in a closed system. The monomer is gradually introduced before the end of the narrow zone and the rate of addition is controlled so that some polymerization occurs before recirculation and the mixture has only a slight vapor pressure. USP 2,729,610.

NISHIJIMA and Oster found that the local viscosity of dilute polymer solutions is almost equal to the viscosity of the solvent, although the microscopic viscosity may be much larger. Above a critical concentration, the local viscosity increases rapidly and then levels off to a constant value. The critical value varies inversely with the molecular weight and the rise is more abrupt with low molecular weight materials. Above the critical concentration, the molecules overlap and the local viscosity depends on the nature of the side chains and the rigidity of the macromolecule. This can be correlated in practice with the wet spinning of fibers; the concentration must be above the critical value to the spinnable, suggesting that the molecules must be entangled to give cohesion and result in a fiber. JPS, *19*, 337 (1956).

LOCAL VISCOSITY of polymers can be determined by measuring the fluorescence of compounds containing substituted phenyl groups capable of internal rotation. Fluorescence increases with increasing viscosity of the medium, and the method can be used for macro viscosity of non polymeric systems. JACS, *78*, 1581 (1956).

ACCORDING TO SKINNER, *et al*, a volume electrostatic charge distribution exists in plastics and cannot be removed in any short period by surface treatment alone. At the point of contact between a metal and plastic, a transfer of charge into the plastic takes place, and when the bond is broken, a measurable transient potential appears. The extended periods when polymers retain a charge are explained by the diffusion of charge through the plastic. Radioisotopes were ineffective in decreasing the charge. MP, *33*, #6, 127 (1956).

SALDICK reported that ceric salts in acid solution could initiate vinyl polymerization in the dark or photochemically at room temperature via a free radical mechanism. JPS, *19*, 73 (1956).

VARIOUS amine salts of p-toluene sulfonic acid can be used as accelerators in benzoyl peroxide catalyzed polymerization of methyl methacrylate, without removal of the inhibitor. The aromatic salts are very efficient, but produce colored products. Aliphatic compounds do not yield colored products, but increase the set time. JPS, *19*, 311 (1956).

BRAUER, *et al*, followed amine accelerated reactions with an ultrasonic viscometer. The rate of polymerization does not always follow the rate of accelerated decomposition of the initiator in nonpolymerizable solvents and does not proceed to completion with many amine-peroxide systems. The efficiency of amine accelerated polymerization in a monomer-polymer slurry may be different from that within straight monomer. MP, *34*, #3, 153 (1956).

IMOTO, *et al*, find that dimethyl aniline decreases the polymerization rate of vinyl, acrylic and styrene monomers without affecting the initiation step. A chain transfer reaction leads to a charged radical which cannot initiate further polymerization. JPS, *22*, 137 (1956).

KENDALL & MANN studied the ozonization of thin films of hevea and acrylonitrile-butadiene rubbers. Spontaneous scission occurs at the carbon-carbon double bonds, producing aldehydes or ketones and peroxy biradicals. The chain reaction can be suppressed by the presence of small amounts of phenyl-β naphthylamine, but the cracking of stretched vulcanizates still occurs. JPS, *18*, 503 (1956).

SZWARC suggests that carbon black filled polymers are stabilized from degradation by ultraviolet and other free radical producing agents because the carbon acts as a radical trap and the particles can bridge the degrading polymer molecules. Active spots are present on the free edges of the ring system from the irregularity of the surface and also occur in the highly condensed aromatic ring system. JPS, *19*, 589 (1956).

SCHEIBER attempted to assign Q and e values to fatty acid products although steric effects complicate the situation. The values indicate that copolymerization of ricinenic acid and styrene would be difficult and that acrylic esters or vinyl acetate are more suitable comonomers. The theory does not explain the beneficial effect of α-methyl styrene on styrene copolymerizations, and this is postulated as a solubility effect. Fette-Seifen-Anstrichmittel, *57*, 71 (1955).

MONOMERIC phthaloyl peroxides have been prepared by Greene. The compounds added to stilbene but did not initiate the polymerization of styrene. JACS, *78*, 2246, 2250 (1956).

SZWARC, *et al*, announced a method of forming "living" polymers. By using sodium naphthalene, styrene could be polymerized at low temperatures by electron transfer. The polymer has active ends which retain their activity for long periods. By adding a second monomer, polymerization again begins and block polymers can be prepared. JACS, *78*, 2656 (1956).

THE FUNDAMENTALS of rheology and their application to paint systems were reviewed by Street. JOCCA, *39*, 391 (1956).

KIPLING discussed physical absorption by solids from binary mixtures and the orientation of absorbed molecules in terms of size and shape. JOCCA, *39*, 641 (1956).

STATISTICAL techniques and their applications to the protective coatings industry were described by Touchin and were extensively treated by Prane. PM, *26*, 241,

287 (1956); PVP, *46*, #10, 41 (1956).

NATTA presented a survey of recent work with stereospecific polymerization catalysis and the resulting isotactic polymers. MP, *34*, #9, 169 (1956).

LONG, Whitemarsh and Yuan used the Langmuir balance to study adhesion. Acetyl and methylol groups increase the adhesion of abietates to water, while the methyl group lowers it. Adhesion decreases as the temperature is raised. The adhesion of linseed oil increases with increasing oxidation, but interaction between oxygenated groups not in the surface of the water causes the curve to flatten off. There are differences in adhesion and in the molecular dimensions between oil films oxidized on a surface and those blown at elevated temperatures. Adhesion to different hydrophilic substances was of the same order of dimension. APJ, *41*, #8, 112 (1956); OD, *28*, 1231 (1956).

THREE new methods of preparing block copolymers have been described. A bifunctional initiator, m-di-(hydroperoxy-isopropyl) benzene in bulk polymerization of styrene yields homopolymers with hydroperoxy terminating groups which can initiate emulsion polymerization with methyl methacrylate in the presence of ferrous ions. Gamma irradiation of vinyl acetate emulsion produces homopolymers with interminated radicals. By removal of the source and the addition of a methyl methacrylate emulsion, polymerization is resumed to give block polymers. In the third method, a mixture of two different polymers is degraded in solution by ultrasonics. The resultant radicals then cross-terminate. Nature, *177*, 190 (1956).

THE CHAIN transfer characteristics of styrene with thiol, alcohol and nitrile groups was studied by Morton, *et al.* The oxy radical may be only 5-10 times more active than a carbon radical towards hydrogen abstraction, indicating that it is improbable that the type of initiator used can seriously affect the degree of branching in a polymer chain. JACS, *78*, 5394 (1956).

ANALYSIS

THE FEDERATION committee proposed the following standards and methods of test for the paint industry:

1) Heptane Humber of Hydrocarbons.
2) Nitrocellulose Diluting Power of Hydrocarbon Solvents
3) Roundness of Glass Spheres
4) Total Chloride in Polyvinyl Chloride Polymers.
5) Evaluating Degree of Resistance of Traffic Paint to Chipping
6) Acetone Extract in Black Pigments
7) Chemical Analysis of Dry Red Lead
8) Chemical Analysis of Yellow, Orange, Red and Brown Pigments containing Iron and Manganese.
9) Specifications for Zinc Oxide
10) Specifications for Basic Carbonate White Lead
11) Specifications for Shellac Varnishes
12) Specifications for Ethyl Acetate (85-88%)

OD, *28*, 5, 87, 173, 252, 410 (1956).

CRAIG AND HENDERSON described an improved Ubbelohde Viscometer for dilute polymer solutions, eliminating kinetic energy corrections. JPS, *19*, 215 (1956).

YANKS designed a simple, compact osometer JPS, *19*, 437 (1956).

MLEJNEK described the determination of the hydroxyl value of mono and diglycerides, oils and alkyds by treatment with acetic and sulfuric acids and titrating the water of esterification with Karl Fischer reagent. Chem. Zvesti, *9*, 27 (1955).

VON RUDLOFF split long chain unsaturated compounds into acids with a combination of permanganate and periodate at low temperatures under slightly basic conditions. Insoluble samples can be treated in pyridine. Quantitative reactions occurred with acids, but poor results were found with methyl oleate and triolein. The central portion of linoleic acid is completely destroyed and no malonic acid could be isolated. JAOCS, *33*, 126 (1956).

A CHROMATOGRAPHIC method of detection and separation of 1-mono-1,3 di-, and triglycerides was developed by Dieckert and Reiser. JAOCS, *33*, 123 (1956).

MONOGLYCERIDES are analyzed by oxidation with potassium periodate in acetic acid containing sulfuric acid. The sample is dissolved in a ternary mixture of phridine, acetic acid and chloroform. Hartman corrects for glycerol content by oxidation with aqueous periodate. Analyst, *81*, 67 (1956).

WHALLEY reviewed newer methods in the analysis of paint materials, including paper and vapor phase chromatography, chelating agents, ion exchange resins, spot tests, and oxygen determinations.

JOCCA, *39*, 193 (1956). Micromethods available for the determination of viscosity, refractive index, density, flash point, molecular weight and acid value were discussed in another article. PT, *19*, 411 (1956). AOCS Official Methods for saponification value, neutralization equivalent, iodine value, solid fatty acids and polyunsaturated acids were adapted to semi micro quantities by Sims and Stone. JAOCS, *33*, 287 (1956).

BERTRAM described the preparation of colorless ethanolic potassium hydroxide. A liter of alcohol is treated with 5 ml of aluminum butylate or isopropylate with stirring and the aluminum hydroxide is decanted before the base is added. The solution contains a little butanol or isopropanol, but is free from aldehyde impurities and remains colorless. Chem. Weekblad, *51*, 677 (1955).

MILLER and Shreve analyzed alkyd-nitrogen resin blends by infrared absorption of thin films at 5.8 (ester carbonyl), 6.5 (amide) and 12.25 mu (triazine). AC, *28*, 200 (1956).

KAPPELMEIER improved his method for detecting melamine resins by hydrolyzing with hydrochloric acid and evaporating to dryness. The cyanuric acid is ex-

tracted with dilute ammonia and detected by precipitation with a cuprammonium salt solution. The test will work for melamine resins in the presence of up to nine parts of urea resins. Verfkroniek, *29*, 40 (1956).

SWANN and Esposito found that a saponification technique can be used for analysis of urea resins. By treating the resin with KOH in ethylene glycol, ammonia is quantitatively released. Melamine, polyamide and acrylonitrile resins do not interfere and good agreement with Kjeldahl analysis is found. AC, *28*, 1984 (1956).

METHYLOL groups in phenolic resins can be determined by treatment with phenol and boron trifluoride. The water which is formed is titrated with Karl Fischer reagent. Carbonyl components must be corrected for. Stenmark and Weiss, AC, *28*, 260 (1956).

SWANN and Weil determined phenolic resins colorimetrically by reacting the resins with nitrous acid, washing with water, measuring the absorbency of the solvent layer at 425 mμ and comparing the results with a standard. Epoxy or other resins do not interfere. Dark paints are best treated with calcium oxide before centrifuging out the pigment. AC, *28*, 1463 (1956).

COLLINS and Sedgwick described a rapid spectrophotometric method for the determination of linoleic and linolenic compoundents of soybean oil using special cells with short light paths. JAOCS, *33*, 149 (1956). Isomerization of unsaturated compounds is improved by the use of potassium t-butoxide in t-butanol, according to Davenport, *et al.* Transparent blanks and no destruction of the product are advantageous over the standard glycol reagent. The reaction has been shown to be first order, and 1,4,7 trienes have a lower activation energy than 1,4 dienes. Chem. and Industry, *1956*, 136.

SREENIVASAN and Brown used this reagent to set up a four hour method for the determination of linoleic and linolenic acids. The stepwise isomerization of polyunsaturated acids is not complicated by side reactions. JAOCS, *33*, 521 (1956).

A SIMPLE modification of the AOCS isomerization tube which aids quantitative transfers of small amounts of material has been proposed. JAOCS, *33*, 305 (1956).

DURBETAKI determined oxirane oxygen by direct potentiometric titration with hydrochloric acid in acetic acid. JAOCS, *33*, 221 (1956). Swann and Esposito use a modified Marquis reagent for the colorimetric determination of bisphenol based epoxy resins and their fatty acids esters in solution or in dried films. AC, *28*, 1006 (1956). Rudd and Zonsveld presented two qualitative tests for epoxy resins or their esters and combinations of these with amines or phenolics. An orange-red color is produced on neutralization of a sulfuric-nitric acid solution, while Deniges reagent yields an orange precipitate. JOCCA, *39*, 314 (1956).

JOHNSON, *et al*, described three methods of determining unsaturated compounds. Treatment with sodium bisulfite or reaction with morpholine can be used for compounds containing electron attracting groups, while a modified Kaufman bromination with increased catalyst is used for other vinyl compounds. The applicability and limitations of each method are discussed. AC, *28*, 73, 76, 126 (1956).

CORCORAN separated short chain mono acids and long chain dicarboxylic acids by chromatography at different acidities on a silicic acid-glycine column with a 1-butanol, chloroform eluent. AC, *28*, 168 (1956).

ZIRCONIUM can be determined by the formation of ammoniacal zirconium tetramandelate and measurement of its absorbance at 258 mu according to Hahn and Weber. AC, *28*, 414 (1956).

BENZOIC ACID in alkyds can be determined by extracting the saponified fatty acids with carbon tetrachloride and determining the absorbitivity of the residue at 273 mu.

SWANN *et al*, recommend slow saponification at 45° for four hours in the case of isophthalic alkyds, as fatty acid contaminants tend to precipitate under ordinary conditions. They also point out that most stopcock greases interfere with fatty acid analysis because of solubility in carbon tetrachloride, and recommend the use of Teflon or self lubricating stopcocks. AC, *28*, 72 (1956).

A SIMPLE method for the direct precipitation of metal oxalates from drier solutions is to drop the solution onto powdered oxalic acid, heat to 100° and wash with toluene-ether to remove excess acids. The method is not applicable to aluminum, iron, or tin soaps. FL *62*, 92 (1956).

THE OIL content of putty can be reproducibly determined if exact conditions are followed. Paulson recommends ashing a 5 gram sample for one hour at 1000°C. in a platinum crucible. An average or actual whiting loss on ignition must be known. JOCCA, *39*, 469 (1956).

PHENYL MERCURIC acetate can be determined spectrophotometrically when a small amount of perchloric acid is added to an aqueous solution. AC, *28*, 1268 (1956).

LINCOLN, *et al*, describe the analysis of surface active agents. Quaternary ammonium compounds are quantitatively precipitated by phosphotungstic acid. They can be removed from mixtures of polyethylene oxide non-ionic surfactants by ion exchange methods. Analyst, *81*, 18, 100 (1956).

AHLERS reviewed the use of spectrophotometry in the analysis of oils and fats, PT, *20*, 237, 324, 357, 401 (1956). Holman and Edmondson used the Beckman DK-1 instrument in the near infrared (0.9-3.0 microns) and found specific bands for cis unsaturation and hydroperoxide groups. Other structures usually studied in the infra-red region have characteristic bands here.

THE CHEMISTRY and analysis of waxes were reviewed in several

papers. PT, *20*, 328, 361 (1956).

KAMATH and Sheyte studied the color reactions of various rosin derivatives and state that the fluorescence, Liebermann-Storch, Halphen-Hicks, Millon and Gibbs tests are the most useful in distinguishing the various resins from one another. Paintindia, *6*, #3, 29, (1956).

COLLEE describes the analysis of lead compounds in the presence of metallic lead by selective solution with different reagents, followed by determination of the dissolved lead as the sulfate. Anal. Chim. Acta, *14*, 430 (1956).

5,6-BENZOQUINALDIC acid has been suggested as an analytical reagent in the determination of titanium. Anal, Chim. Acta, *14*, 427 (1956).

SZALKOWSKI and Mader determine sodium carboxymethylcellulose by precipitation as the copper salt followed by a colorimetric determination using naphthalene-2,7-diol. The method is lengthy but recoveries of 98.5% are obtained. J. Am. Pharm. Assoc. *44*, 533 (1955).

TESTING

Free Films

COLEMAN, *et al*, prepared smooth gelatin films by casting in a cylinder on carbon tetrachloride, removing the cylinder when gelation has occurred, and allowing the solvent to evaporate from both sides of the film. JPS, *19*, 380 (1956).

HARRIS held matte photographic paper on a vacuum plate and spread the film on the emulsion side. The gelatin could be removed by placing on a wet blotter for 10-15 minutes and the film can be lifted off before it is wetted and absorbs water. Films as thin as 12 microns have been prepared, with only 2-3 micron variations. OD, *28*, 30 (1956).

Exposure Tests

THE ELECTRON microscope was found to be extremely useful in studies of paint film defects such as chalking and film degradation caused by exposure. Twiss, *et al*, examined automobile enamels after exposure to a Uviarc and to weathering. A freshly painted surface is microscopically smooth and all pigment particles are coated with vehicle. Ultraviolet degrades and shrinks the vehicle and exposes loose pigment particles, resulting in loss of gloss and chalking. Natural weathering produces a much rougher surface because of leaching and erosion by water. Polishing removes the degraded surface layer and loose pigment, but microscopic surface scratches remain, where the pigment is not covered by the vehicle. Waxing fills in the scratches, but forms only a partially protective, discontinuous film. An improved sample technique for the electron microscope is described. OD, *28*, 93 (1956).

General

HILLS, *et al*, described an improved method for determining the electrical conductivity of crosslinked polyelectrolytes, resins, and gels. JPS, *19*, 382 (1956).

A SIMPLE gel time meter for pot life determinations has been constructed by soldering a shaft to the second hand of an electric clock. When the resin is set, the clock stops. MP, *33*, #7, 133 (1956).

KONIGSBACHER and Berdick had several individuals who could consistently detect differences between odors rank various paints according to several types of odor at different drying levels. Vinyl and latex paints smelt of citrus, disinfectant, and pine. The solvent odor of alkyds was very persistent, and alkyds had higher odor levels than the other paints. No attempt was made to determine the acceptability of any odor. OD, *28*, 32 (1956).

BITNER and Beal devised two new circuits to measure and record oxygen absorption occurring over long periods. JAOCS, *33*, 36 (1956).

SMITH reports that pencil hardness can be a practical and reproducible criterion of hardness and toughness if strict adherence to detail is observed. One specified make of pencils must be used throughout the test. Pencils should be squared off, pushed at the normal writing angle, the graphite erased with a gum eraser and the film examined at an oblique angle. OD, *28*, 232 (1956).

ADAMS reviewed the fundamental principles of color relationships to spectrophotometric curves and tristimulus colorimetry. PM, *26*, 105 (1956).

COLE derived equations from the Kubelka-Munk theory relating absorption and scatter values of the component pigments in a paint to the reflectivity. Yellow and iron oxides and TiO_2 conform to the theory but chrome yellow and phthalocyanine blue do not. A mechanical computer was designed to eliminate complicated calculations. Examples of the computations for the amount of toner paint to correct off color batches from A, B, and G values are demonstrated. OD, *28*, 624 (1956).

TOUGH developed a new method to measure hiding power. The ratio of luminances of thin films (on cellophane) over black and white surfaces can be numerically related to the hiding power. The method is claimed to have a good correlation with the usual technique and is much more rapid. JOCCA, *39*, 169 (1956).

THE "PROFILIMETER" is an instrument which measures and records surface roughness. Hess describes its correlation with gloss and fineness measurements, and points out other possible applications to the coatings field. JOCCA, *39*, 185 (1956).

ROGERS described apparatus for scrub tests, an optical method for film thickness, an automatic modification of the Erichsen machine, and an apparatus to introduce ozone for gas checking tests. Verfkroniek, *29*, 41 (1956).

PRAGST claims that Erickson or other tensile strength measurements are unrealistic because a single stress disrupts the film. By applying films to a rubber ball which is then continuously partially

deflated and inflated, the film can be subjected to continuous dimensional changes. The apparatus is described in Farbe u. Lacke, *62*, 59 (1956).

BRIGHTWELL described the use of an optical slit microscope to measure film thickness. A prism of light is projected onto a portion of free film which has been slit and the distortion of the light caused by the surface roughness is observed. A standard deviation of 0.053 mils was found for films in the 0.1 to 10 mil range with 75X magnification and is less at higher powers. OD, *28*, 412 (1956).

RADIOACTIVE isotopes have been used to study permeability of films. The varnish is sprayed over a gelatin membrane mounted over one end of a glass tube which is then filled with a solution of Rb^{86} and immersed in distilled water, or else sprayed over a glass panel which has been coated in the center with a gelatin solution containing Rb^{86}. Permeability is measured by the increase in radioactivity of the water. J. Sci. Ind. Research (India), *14*, 549 (1955).

A METHOD for determining the softening point of hard resins by noting the temperature at which a plug is forced from an orifice under pressure is said to minimize errors due to sample preparation and operator effect. Diamond states that the values obtained by this procedure lie 10-20°C. below those from the Durran's or Ball and Ring tests. JOCCA, *39*, 472 (1956).

BRITISH government and trade paint testing methods were critically discussed by Jelpke and Walker. PM, *26*, 247 (1956).

SCHRUMPF, Carter, and Hader present a study of mandrel flexibility and cold checking of lacquers. In a good example of the application of statistics, they show close correlation between the two tests. The stress is greatest at right angles to the grain, and checks are therefore parallel to the face grain of the wood. OD, *28*, #379(2), 79 (1956).

Exposure

BLOCH surveyed test methods and correlations between artificial aging and field conditions with a view toward extreme environments. APJ, *41*, #14, 106 (1956). Edwards and Jenkins reported on exposure test methods used by the British ministry of supply. PM, *26*, 367, 411 (1956). The construction details for an accelerated blister test box were described by Levin and Christian. NPVL Circular #772 (1956).

HARRIMAN designed a permanent magnet thickness gage which can be used over small areas over a 0-60 mil range. The substrate must be magnetic but not magnetized. APJ, *41*, #9, 80 (1956).

Viscosity

TWO CONE and plate type viscometers have been described. McKennell compared the Ferranti-Shirley instrument with the coaxial cylinder type and points out that there is less inherent error and more rapid cleaning and use under constant shear conditions with the plate-cone machine. Mell and Ford use a two range (0-15 and 0-3000 sec. -1) instrument in which the torque is registered by strain gages and virtually instantaneous measurements of the shearing stress are possible. A paint can be sheared at a constant rate or at a constantly accelerating rate. The clearance of 1-6 mils approximates that of a normal paint film. Data are presented for manufacturing control of gelled alkyds and for mill grinding bases, but correlation in the latter case is not fully understood. JOCCA, *39*, 832, (1956); OD, *28*, 1214 (1956).

BERBERIAN, *et al*, checked data from the Asbeck-Laidermann-Van Loo high-shear viscometer against committee ratings of brushability. Paints having a viscosity under three poises in the 12,000-35,000 -1 sec. range usually were rated as having good brushing properties, but the greater the slope of the curve in this region, the more erratic were the ratings between individual panelists. It is difficult to differentiate between paints which have easy brushing characteristics, especially with emulsion paints. OD, *28*, 1037 (1956).

SEVERAL methods have been investigated to determine incompatibility. Evans, *et al*, examined solution transmittance, film transmittance, densitometry, viewing with direct and scattered light, and by low magnification photomicroscopy. Transmitted light is more sensitive than direct light. Photomicrographs are useful for gross incompatibility, which may be mistaken because the systems develop macrostructures which do not absorb or scatter light. Deviations from Beer's law indicates incompatibility in solution mixtures. OD, *28*, 985 (1956).

CLAVER & MERZ discussed the usage and techniques of phase and electron microscopy in the study of heterogeneous polymer systems. OD, *28*, 858 (1956).

A SIMPLE apparatus for the statistical evaluation of particle size distribution from photomicrographs is described by Endter and Bebauer. Optik, *13*, 97 (1956).

APPENDIX

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A

Paul O. Abbe, Inc.
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Abbe Engineering Company
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Acheson Colloids Company
Port Huron, Mich.

Acheson Dispersed Pigments Co.
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Philadelphia 34, Pa.

Acme Shellac Products Co.
108 Blanchard Street
Newark 5, New Jersey

Adco Chemical Company
148 - 154 Rome Street
Newark 1, N. J.

Advance Solvents & Chemical Corporation
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New York 16, N. Y.

Air Reduction Chemical Company
A Division of Air Reduction Company, Inc.
150 East 42nd St.
New York 17, N. Y.

Alkydol Laboratories, Inc.
3242 South Fiftieth Ave.
Cicero 50, Ill.

Allied Asphalt & Mineral Corporation
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New York 7, N. Y.

Allied Research Products, Inc.
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Baltimore 5, Md.

Alsop Engineering Corporation
Milldale, Connecticut

Aluminum Company of America
Alcoa Building
Pittsburgh 19, Pa.

C. M. Ambrose Company
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Seattle 8, Washington

American Alcolac Corporation
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Baltimore 26, Md.

American Alkyd Industries
Broad & 14th Street
Carlstadt, N. J.

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New York, N. Y.

American Chemical Paint Company
Ambler, Pa.

American Cyanamid Company
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American Gilsonite Company
134 West Broadway
Salt Lake City, Utah

American Lecithin Company, Inc.
57 - 01 32nd Avenue
Woodside, L. I. 77, N. Y.

American Mineral Spirits Company
Mountain View
Murray Hill, N. J.

American Potash & Chemical Corp.
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Los Angeles 54, Calif.

American Research Corp.
Bristol, Conn.

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910 S. Michigan Avenue
Chicago 80, Ill.

Analytical Measurements, Inc.
585 Main Street
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Oklahoma City 2, Oklahoma

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Ansul Chemical Company
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New York 14, N. Y.

Archer Daniels Midland Company
Investors Bldg.
Minneapolis 2, Minn.

Argus Chemical Corp.
633 Court Street
Brooklyn 31, N. Y.

Aries Laboratories, Inc.
270 Park Avenue
New York 17, N. Y.

Arizona Chemical Company
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New York 20, N. Y.

Armour Chemical Division
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New York 16, N. Y.

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714 Division Street
Elizabeth, N. J.

Automatic Transportation Company
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Automotive Rubber Company, Inc.
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Detroit 39, Mich.

B

Baird Associates, Inc.
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Bakelite Company
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New York 17, N. Y.

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120 Broadway
New York 5, N. Y.

Baker Perkins Inc.
Saginaw, Michigan

Barber Asphalt Corp.
Barber, New Jersey

Bareco Oil Company
P.O. Box 2009
Tulsa, Oklahoma

Charles E. Barker Company
P.O. Box 85
Bladensburg, Maryland

Barksdale Company
921 Bergen Avenue
Jersey City 6, N. J.

H. L. Barnebey
P.O. Box 144
Pittsburgh 30, Pa.

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Northbrook, Illinois

Barrett Division
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New York 6, N. Y.

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Peotone, Ill.

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Chicago 12, Illinois

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Grand Rapids 9, Mich.

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Blaw Ave.
Blaw Knox, Pa.

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Chemical Div.
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New York 17, N. Y.

The Borden Company
Chemical Div.
Monomer Dept.
350 Madison Ave.
New York 17, N. Y.

The Borden Company
Chemical Div.
Polyco Dept.
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New York 17, N. Y.

The Borden Company
Chemical Div.
Resinous-Reslac Dept.
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New York 17, N. Y.

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New York 4, N. Y.

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New York, N. Y.

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Cincinnati, Ohio

Brookfield Engineering Laboratories, Inc.
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St. Louis 10, Mo.

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Buckman Laboratories, Inc.
Memphis 8, Tenn.

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Burgess Pigment Company
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Sandersville, Georgia

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Burt Machine Company
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The Burtonite Co.
Nutley 10, N. J.

C

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Flour Exchange Bldg.
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Charlotte, N. C.

Carrier Conveyor Corp.
Frankfort Avenue at Clifton Avenue
Louisville 6, Ky.

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535 Fifth Avenue
New York 17, N. Y.

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North Haven, Conn.

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Detroit 8, Mich.

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Chemical Div.
180 Madison Ave.
New York 16, N. Y.

Celanese Corp. of America
Plastics Div.
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Cellofilm Corporation
Union Avenue
Woodridge, N. J.

Central Solvents & Chemicals Company
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Chicago 12, Illinois

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Fort Wayne, Ind.

Chemical and Pharmaceutical Industry Co., Inc.
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New York 7, N. Y.

Chemical & Pigment Co.
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Oakland, Calif.

Chemical Prods. Corp.
P.O. Box 61
Little Falls, N. J.

Chemical Solvents, Inc.
60 Park Place
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Chemirad Corp.
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Chisholm-Ryder Company of Pennsylvania
Hanover, Pennsylvania

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New York, N. Y.

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Roslyn Hts., L. I., N. Y.

Clark Equipment Company
Battle Creek, Mich.

Cleveland Aerosol Packaging Corp.
Division of Plasti-Kote, Inc.
9801 Harvard Avenue
Cleveland, Ohio

The Cleveland Steel Barrel Company
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Cleveland 5, Ohio

Climax Molybdenum Co.
500 Fifth Avenue
New York 36, N. Y.

Collway Colors Incoporated
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Paterson, N. J.

The Colton Chemical Company
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Cleveland, Ohio

Columbia-Southern Chemical Corp.
Subsidiary of Pittsburgh Plate Glass Company
2 Gateway Center
Pittsburgh 22, Pa.

Columbian Carbon Company
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New York, N. Y.

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Minneapolis, Minn.

Combustion Engineering, Inc.
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Chicago 22, Ill.

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Toledo Factories Bldg.
Toledo 2, Ohio

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Conn and Co.
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Warren, Pennsylvania

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141 Jefferson
Holland, Michigan

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New York 17, N. Y.

Continental Carbon Co.
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New York 17, N. Y.

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New York, N. Y.

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Cleveland 3, Ohio

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Box 111
Picayune, Miss.

Crown Can Div.
Crown Cork & Seal Co.
H St. & Erie Ave.
Philadelphia, Pa.

Crown Engineering & Sales Co.
421 Hill Street
Harrison, N. J.

Crownoil Chemical Co., Inc.
2-14 49th Avenue
Long Island City 1, N. Y.

The Cuno Engineering Corporation
Meriden, Connecticut

Cuprinol Division
Darworth Incorporated
Simsbury, Conn.

D

The Dacar Chemical Products Company
McCartney at Wabash Street
West End
Pittsburgh 20, Pa.

The Davies Can Company
8007 Grand Ave.
Cleveland 4, Ohio

The Davison Chemical Company
Baltimore 3, Maryland

The J. H. Day Company, Inc.
Div. Cleveland Automatic Machine Co.
Cincinnati 22, Ohio

Delaware Chemicals, Inc.
P.O. Box 1772
Wilmington, Del.

Delou, Inc.
20-22 Fletcher Street
New York 38, N. Y.

The Denison Engineering Company
1160 Dublin Road
Columbus 16, Ohio

Despatch Oven Company
619 S.E. Eighth Street
Minneapolis 14, Minnesota

Detrex Corporation
Box 501
Detroit 32, Michigan

The DeVilbiss Company
Toledo 1, Ohio

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Diamond Alkali Company
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Cleveland 14, Ohio

Distillation Products Industries
Rochester 3, N. Y.

Dixie Pine Products
P.O. Drawer
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180 Varick Street
New York 14, N. Y.

The Dow Chemical Company
Midland, Mich.

Dow Corning Corp.
Midland, Mich.

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242 Stevens St. S. W.
Grand Rapids 2, Mich.

Drage Products
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Union City, N J.

E. F. Drew & Co., Inc.
15 East 26th Street
New York 10, N. Y.

Dri-Flo Mfg. Company
642 East Ten Mile Road
Hazel Park, Mich.

Dry Ice Converter Corporation
Box 1652
Tulsa, Oklahoma

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Cincinnati 3, Ohio

E. I. duPont de Nemours & Company
Electrochemicals Dept.
Pigments-Color
White
Wilmington 98, Del.

Dura Commodities Corporation
20 Vesey Street
New York 7, N. Y.

Durez Plastics & Chemicals, Inc.
North Tonawanda, New York

E

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American Building
Cincinnati 1, Ohio

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55 Berry St.
Brooklyn, N. Y.

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Mixer Division
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Eastern States Chemical Corporation
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Houston 12, Texas

Eastman Chemical Products, Inc.
Kingsport, Tennessee

Eco Engineering Company
12 New York Avenue
Newark 1, N. J.

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Oakland, Calif.

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Emery Industries, Inc.
Carew Tower
Cincinnati 2, Ohio

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Enjay Company, Inc.
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New York 19, N. Y.

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8809 Epworth Boulevard
Detroit 4, Mich.

Esso Standard Oil Company
15 West 51st Street
New York 19, N. Y.

Ethyl Corporation
100 Park Avenue
New York 17, N. Y.

F

The W. H. Fales Company
609 Clinton Street
Brooklyn 31, N. Y.

Fallek Products Company, Inc.
165 Broadway
New York 6, N. Y.

Falls Industries, Inc.
Aurora Road
Solon, Ohio

Farac Oil and Chemical Company
145th Street and Indiana Avenue
Chicago 27, Ill.

Farnow, Inc.
4-80 47th Road
Long Island City 1, N. Y.

Federal Color Laboratories, Inc.
4630 Forest Avenue
Norwood, Cincinnati 12, Ohio

Federal Latex Corporation
210-220 Wythe Avenue
Brooklyn 11, N. Y.

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50th Street & 1st Ave.
Brooklyn, N. Y.

Ferro Corporation
4150 East 56th Street
Cleveland 5, Ohio

Filpaco Industries, Inc.
2463 South Michigan Avenue
Chicago 16, Ill.

Fine Colors Company
21-29 McBride Avenue
Paterson, N. J.

Fine Organics, Incorporated
211 East 19th Street
New York 3, N. Y.

Finish Engineering Co., Inc.
115 Cherry Street
Erie, Pa.

Firestone Plastics Company
P.O. Box 690
Pottstown, Pa.

Fisher Scientific Company
717 Forbes Street
Pittsburgh 19, Pa.

Florida Molasses Corporation
P.O. Box 366
Auburndale, Florida

Foster Pump Works, Inc.
50 Washington Street
Brooklyn, N. Y.

The Fostoria Pressed Steel Corporation
Fostoria, Ohio

France, Campbell & Darling, Inc.
Kenilworth, N. J.

Franklin Mineral Products Company
Franklin, North Carolina

Freeman Chemical Corporation
211 East Main Street
Port Washington, Wisconsin

Fritzsche Brothers, Inc.
76 Ninth Avenue
New York 11, N. Y.

Fuller Company
Catasauqua, Pa.

Furane Plastics, Inc.
4516 Brazil Street
Los Angeles 39, Calif.

G

Gabb Special Products
Windsor Locks, Conn.

Gallowhur Chemical Corporation
N. Water St.
Ossining, N. Y.

Gardner Laboratory Inc.
4723 Elm Street
Bethesda 14, Md.

Geigy Industrial Chemicals
89 Barclay Street
New York 8, N. Y.

General Aniline & Film Corporation
435 Hudson St.
New York 14, N. Y.

General Carbon Company
7542 Maie Ave.
Los Angeles 1, Calif.

General Ceramics Corporation
Keasbey, N. J.

General Color Company
24 Avenue B
Newark 5, N. J.

General Dyestuff Corporation
435 Hudson Street
New York 14, N. Y.

General Electric Company
Chemical Materials Dept.
77 River Rd.
Schenectady, N. Y.

General Latex & Chemical Corp.
666 Main Street
Cambridge 39, Mass.

General Mills, Inc.
Chemical Division
400 Second Ave., S
Minneapolis, Minn.

General Printing Corp.
Ft. Wayne, Ind.

The General Tire & Rubber Co.
Chemical Division
Akron, Ohio

Georgia Kaolin Co.
433 N. Broad St.
Elizabeth, N. J.

Geuder Paeschke & Frey Co.
324 N. 15th St.
Milwaukee 1, Wisconsin

Gillespie-Rogers-Pyatt Co. Inc.
75 West Street
New York 6, N. Y.

The Girdler Company
Louisville 1, Kentucky

Givaudan-Delawanna, Inc.
330 West 42nd Street
New York 36, N. Y.

The Glidden Company
Chemicals-Pigments-Metals Division
1396 Union Commerce Building
Cleveland 14, Ohio

The Glidden Company
Naval Stores Division
P.O. Box 389
Jacksonville 1, Florida

Glycerine Corp. of America
36 W. 44 St.
New York, N. Y.

Glyco Products Co., Inc.
Empire State Bldg.
New York 1, N. Y.

B. F. Goodrich Chemical Co.
3135 Euclid Ave.
Cleveland, Ohio

The Goodyear Tire & Rubber Co., Inc.
Chemical Division
Akron 16, Ohio

Carl Gorr Color Card, Inc.
3837 W. Roosevelt Road
Chicago 24, Ill.

Goulds Pumps, Inc.
Seneca Falls, N. Y.

T. F. Gowdy Co.
2 Broadway
New York 2, N. Y.

Grace Chemical Company
Division of W. R. Grace & Co.
Edway Bldg.
Memphis 3, Tenn.

Great Lakes Carbon Corporation
Dicalite Div.
612 South Flower Street
Los Angeles 17, Calif.

The Greif Bros. Cooperage Corporation
Cleveland 13, Ohio

The Emil Greiner Company
20-26 N. Moore Street
New York 13, N. Y.

The Griffith Laboratories
1415 W. 37th Street
Chicago 9, Ill.

A. Gross & Co.
295 Madison Ave.
New York 17, N. Y.

The G. S. Equipment Company
5317 St. Clair Avenue
Cleveland 3, Ohio

Guardian Chemical Corp.
10-15 43rd Avenue
Long Island City 1, N. Y.

Gulf Oil Corporation
17 Battery Place
New York 4, N. Y.

H

Wm. J. Hacker & Co., Inc.
82 Beaver Street
New York 5, N. Y.

Haeuser Shellac Co., Inc.
52 Warren Street
Brooklyn, N. Y.

Alfred Hague & Co., Inc.
227d - 34th Street
Brooklyn 32, N. Y.

Hansborg & Company
P.O. Box 152
80 Longview Road
Port Washington, L. I., N. Y.

Harchem Division
Wallace & Tiernan, Inc.
Box 178
Newark 1, N. J.

Harding Company, Inc.
York, Pennsylvania

Charles J. Hardy, Inc.
420 Lexington Ave.
New York, N. Y.

The Harshaw Chemical Co.
1945 East 97th Street
Cleveland 6, Ohio

Harwick Standard Chemical Company
60 South Seiberling Street
Akron 5, Ohio

Hayden Mica Company
Wilmington, Massachusetts

Hayes Adhesives Co., Inc.
630 W. 51st Street
New York 19, N. Y.

Hellige, Inc.
Garden City, N. Y.

Hercules Powder Company
Wilmington 99, Delaware

Herman Hockmeyer & Co.
341 Coster Street
New York 59, N. Y.

Hermas Machine Company Inc.
225 Warburton Avenue
Hawthorne, N. J.

Heyden Chemical Corporation
342 Madison Avenue
New York 17, N. Y.

Hinde & Dauch
Sandusky, Ohio

Holland Colors & Chemical Company
Holland, Michigan

Hooker Electrochemical Company
Niagara Falls, N. Y.

Hope Machine Co.
9400 State Road
Philadelphia, Pa.

The Hopkins Company
150 Nassau Street
New York 38, N. Y.

Howards & Sons (Canada) Ltd.
247 Dunbar Avenue
Montreal, Quebec

J. M. Huber Corporation
100 Park Avenue
New York 17, N. Y.

Humphrey-Wilkinson, Inc.
North Haven, Conn.

Hy-R-Speed, Inc.
3139 Casitas Avenue
Los Angeles 39, Calif.

I

Imperial Paper and Color Corporation
Glen Falls, N. Y.

Indoil Chemical Company
910 South Michigan Avenue
Chicago 80, Ill.

Industrial Filter & Pump Mfg. Co.
5900 Ogden Avenue
Chicago 50, Illinois

Industrial Ovens, Inc.
13825 Triskett Road
Cleveland 11, Ohio

Industrial Products Company
2820 N. Fourth Street
Philadelphia 33, Pa.

Industrial Radiant Heat Corp.
P.O. Box 123
Gladstone, N. J.

Ingersoll-Rand Company
Phillipsburg, N. J.

Inland Steel Container Co.
38 South Dearborn Street
Chicago 3, Ill.

O. G. Innes Corporation
82 Wall Street
New York 5, N. Y.

Innes, Speiden & Co. Inc.
420 Lexington Avenue
New York 17, N. Y.

Interchemical Corporation
67 W. 44th St.
New York, N. Y.

International Engineering, Inc.
Dayton 1, Ohio

International Wax Refining Corp.
E. Hawthorne Avenue
Valley Stream, N. Y.

Isocyanate Products, Inc.
P.O. Box 1681
Wilmington, Delaware

J

Jefferson Chemical Company Inc.
260 Madison Ave.
New York 16, N. Y.

Johns-Manville
22 East 40th Street
New York 16, N. Y.

Jones & Laughlin Steel Corporation
3 Gateway Center
Pittsburgh 30, Pa.

Jones-Dabney Company
Louisville, Ky.

K

Kay-Fries Chemicals, Inc.
180 Madison Avenue
New York 16, N. Y.

Kelco Company
120 Broadway
New York 5, N. Y.

The M. W. Kellogg Company
Jersey City 3, N. J.

Spencer Kellogg and Sons, Inc.
Buffalo 5, N. Y.

The C. M. Kemp Mfg. Co.
405 East Oliver Street
Baltimore 2, Md.

Kenrich Corp.
57-02 48th Street
Maspeth 78, N. Y.

Kent Machine Works, Inc.
37-39-41 Gold Street
Brooklyn 1, N. Y.

Kentucky Color and Chemical Co.
600 North 34th Street
Louisville 12, Ky.

Walter Kidde & Co., Inc.
Belleville 9, N. J.

The Karl Kiefer Machine Company
Cincinnati 2, Ohio

Kinetic Dispersion Corporation
95 Botsford Place
Buffalo 16, N. Y.

King Sales & Engineering Co.
441 Folsom Street
San Francisco 5, Calif.

Kiem Chemicals, Inc.
14401 Lanson Avenue
Dearborn, Mich.

George Koch Sons, Inc.
P.O. Box 358
Evansville 4, Indiana

H. Kohnstamm & Co., Inc.
83-93 Park Pl.
New York 7, N. Y.

Kolker Chemical Works, Inc.
80 Lister Avenue
Newark 5, N. J.

Koppers Company, Inc.
Chemical Division
Pittsburgh 19, Pa.

Kosmos Electro-Finishing Research, Inc.
13 Valley Street
Belleville, N. J.

Kraft Chemical Company, Inc.
917 West 18th Street
Chicago 8, Illinois

Kromall Chemical & Dispersions Corp.
10-12 46th Avenue
Long Island City 1, N. Y.

Krumbhaar Chemicals, Inc.
24-30 Jacobus Avenue
South Kearny, N. J.

The Kwerel Company
161 Crescent Court
Englewood, N. J.

L

Lee Metal Products Co., Inc.
Philipsburg, Pa.

Leeds & Northrup Company
4907 Stenton Avenue
Philadelphia 44, Pa.

J. M. Lehmann Company, Inc.
550 New York Avenue
Lyndhurst, N. J.

Linde Air Products Company
30 E. 42nd Street
New York 17, N. Y.

Lindquist Pump Corp. of Texas
2207 Border Avenue
Torrance, Calif.

Liquid Carbonic Corp.
3100 S. Kedzie Ave.
Chicago 23, Ill.

C. W. Logeman Company
633 Bergen Street
Brooklyn 17, N. Y.

The Lunkenheimer Company
405 Lexington Avenue
New York 17, N. Y.

LZP Industrial Ceramics Co.
275 Kalamath Street
Denver 23, Colorado

M

Macbeth Corp. & Subsidiaries
Newburgh, N. Y.

Magna Manufacturing Co., Inc.
Haskell, New Jersey

Magnus, Mabee & Reynard, Inc.
16 Desbrosses Street
New York 13, N. Y.

Magruder Color Company, Inc.
2385 Richmond Terrace
Staten Island 2, N. Y.

Mallinckrodt Chemical Works
Second & Mallinckrodt Sts.
St. Louis 7, Mo.

Manton-Gaulin Manufacturing Co., Inc.
44 Garden Street
Everett 49, Massachusetts

Marathon Corporation
Chemical Division
Rothschild, Wis.

The Marblette Corporation
37-21 30th Street
Long Island City 1, N. Y.

Marbon Chemical Division
Borg-Warner Corp.
1926 West Tenth Avenue
Gary, Indiana

Marco Company, Inc.
Third & Church Streets
Wilmington 50, Del.

Market Forge Company
Everett 49, Mass.

Marlow Pumps
Box 566
Ridgewood, N. J.

Matherson-Selig Co.
1815 North Central Park Avenue
Chicago, Illinois

McCloskey Varnish Co.
Philadelphia 36, Pa.

McDanel Refractory Porcelain Co.
Beaver Falls, Pennsylvania

The McGeon Chemical Co.
1040 Midland Bldg.
Cleveland 15, Ohio

The Mead Corporation
Chillicothe, Ohio

M & E Manufacturing Company
2571 Winthrop Ave.
Indianapolis 5, Indiana

Merck & Co., Inc.
Chemical Division
Rahway, N. J.

The Mercury Manufacturing Company
4044 South Hasted Street
Chicago 9, Ill.

Merkle-Korff Gear Company
213 N. Morgan Street
Chicago 7, Ill.

Metal & Thermit Corporation
100 East 42nd Street
New York 17, N. Y.

Metalead Products Corporation
2901 Park Blvd.
Palo Alto, Calif.

Metals Disintegrating Company, Inc.
Elizabeth (B), New Jersey

Metalsalts Corporation
200 Wagaraw Road
Hawthorne, N. J.

Metalwash Machinery Corporation
938 N. Avenue
Elizabeth 4, N. J.

Metasap Chemical Company
Harrison, N. J.

Michigan Oven Company
415 Brainard Street
Detroit 1, Mich.

Franklin P. Miller & Son, Inc.
36 Meadow Street
East Orange 13, N. J.

Mine Safety Appliances Company
201 N. Braddock Avenue
Pittsburgh 8, Pa.

Mineral Pigments Corporation
Muirkirk, Maryland

Mineralite Sales Corporation
90 Pine Street
New York 5, N. Y.

Minerals & Chemicals Corporation of America
Menlo Park, N. J.

Minnesota Linseed Oil Company
1101 So. Third St.
Minneapolis, Minn.

Minnesota Mining & Manufacturing Company
900 Fauquier Avenue
St. Paul 6, Minnesota

The Miskella Infra-red Company
East 73rd and Grand Avenue
Cleveland 4, Ohio

The Mitchell-Bradford Chemical Company
2446 Main Street
Stratford, Conn.

Mitchell Industrial Tire Co., Inc.
P.O. Box 468
Chattanooga, Tenn.

Mixing Equipment Co., Inc.
135 Mt. Read Boulevard
Rochester 11, N. Y.

Mobay Chemical Company
St. Louis 4, Missouri

Mona Industries, Inc.
Paterson 4, N. J.

Monsanto Chemical Co.
Plastics Division
Springfield, Mass.

Monsanto Chemical Company
St. Louis, Mo.

Mooney Chemicals, Inc.
2271 Scranton Road
Cleveland 13, Ohio

John B. Moore Corporation
Nutley 10, N. J.

Morehouse-Cowles, Inc.
1156 San Fernando Road
Los Angeles 65, Calif.

Morningstar, Nicol, Inc.
630 West 51st Street
New York 19, N. Y.

Morse Mfg. Co., Inc.
727 W. Manlius Street
E. Syracuse, N. Y.

MRM Co., Inc.
191-3 Berry Street
Brooklyn 11, N. Y.

Mutual Chemical Co. of America
Block & Willis Sts.
Baltimore 31, Md.

N

Naftone, Inc.
515 Madison Avenue
New York 22, N. Y.

Naresco Equipment Corporation
160 Charlemont Street
Newton Highlands 61, Mass.

Narmco Resins & Coatings Company
600 Victoria Street
Costa Mesa, Calif.

National Aniline Division
Allied Chemical & Dye Corp.
40 Rector Street
New York 6, N. Y.

National Can Corp.
3217 W. 47th Place
Chicago 47, Ill.

National Equipment Corporation
153-7 Crosby Street
New York 12, N. Y.

National Foam System, Inc.
W. Chester, Pa.

National Lead Company
DeLore Division
111 Broadway
New York 6, N. Y.

National Polychemicals, Inc.
Eames Street
Wilmington, Mass.

National Rosin Oil Products, Inc.
1270 Avenue of the Americas
New York 20, N. Y.

National Starch Prods., Inc.
270 Madison Avenue
New York 16, N. Y.

National Steel Container Corp.
6700 S. Leclaire Avenue
Chicago 38, Ill.

National Wax Company
1300 West Division Street
Chicago 22, Illinois

National Zinc Company, Inc.
Bartlesville, Okla.

Naugatuck Chemical
Naugatuck, Conn.

Neilson Chemical Company
6564 Benson Street
Detroit 7, Mich.

Neptune Meter Company
19 W. 50th Street
New York 20, N. Y.

Neville Chemical Company
Pittsburgh 25, Pa.

New England Tank & Tower Company
Everett, Massachusetts

The New Jersey Zinc Company
160 Front Street
New York 38, N. Y.

Newport Industries, Inc.
230 Park Ave.
New York 17, N. Y.

The New York Air Brake Company
1100 East 222nd Street
Cleveland 17, Ohio

New York Color & Chemical Co.
Belleville 9, N. J.

Ninol Laboratories
1719 South Clinton Street
Chicago 16, Ill.

Nitrogen Division
Allied Chemical & Dye Corp.
40 Rector Street
New York 6, N. Y.

Nopco Chemical Co., Inc.
Harrison, N. J.

Norcross Corp.
Newton 58, Mass.

North American Electric Lamp Co.
1014 Tyler St.
St. Louis 6, Mo.

Northwest Chemical Company
9310 Roselawn
Detroit 4, Mich.

Nova Chemical Corporation
147-153 Waverly Place
New York 14, N. Y.

Nuodex Products Co., Inc.
Elizabeth, N. J.

Nutting Truck and Caster Company, Inc.
Faribault, Minnesota

O

Oakite Products, Inc.
19 Rector Street
New York 6, N. Y.

Ohio-Apex Division
Food Machinery & Chemical Corp.
Nitro, West Virginia

Olin Mathieson Chemical Corp.
Mathieson Bldg.
Baltimore 3, Md.

Onyx Oil & Chemical Company
Warren & Morris Sts.
Jersey City 2, N. J.

The OP-AL Electric & Manufacturing Co.
809 N. Senate Ave.
Indianapolis 2, Indiana

Oronite Chemical Company
200 Bush St.
San Francisco, Calif.

C. J. Osborn Company
132 Nassau Street
New York 7, N. Y.

Ovens For Industry, Inc.
2032 W. 105th Street
Cleveland 2, Ohio

P

The Pacific Lumber Company
100 Bush Street
San Francisco, Calif.

Pacific Vegetable Oil Corp.
62 Townsend St.
San Francisco, Calif.

Paisley Products, Inc.
630 W. 51st Street
New York 19, N. Y.

Pan American Chemical Div.
122 East 42nd Street
New York 17, N. Y.

Parker Rust Proof Company
Detroit 11, Mich.

M. W. Parsons-Plymouth, Inc.
55 Beekman St.
New York 38, N. Y.

The Patterson Foundry & Machine Company
East Liverpool, Ohio

The Patterson-Kelly Co., Inc
Warren Street
East Stroudsburg, Pa.

Peerless Color Company, Inc.
521-535 North Avenue
Plainfield, N. J.

Peiron Corp.
7740 W. 47th Street
Lyons, Illinois

Penetray Corporation
615 Front Street
Toledo 5, Ohio

The Pennebacker Company
Emmaus, Pennsylvania

Pennsylvania Color & Chemical Co.
Pine Run Road
Doylestown, Pa.

Penn. Ind. Chem. Corp.
Clairton, Pa.

Pennsylvania Refining Company
Butler, Pa.

Pennsylvania Salt Manufacturing Co.
1000 Widener Bldg.
Philadelphia 7, Pa.

Penola Oil Company
15 West 51st Street
New York 19, N. Y.

The Perkin-Elmer Corporation
Norwalk, Connecticut

Petrochemicals Company
1825 E. Spring Street
Long Beach 6, Calif.

Petroleum Specialties Company
4030 Chouteau Avenue
St. Louis 10, Missouri

Petrolite Corp., Ltd.
30 Broad Street
New York 4, N. Y.

Petrometer Corporation
43-22 Tenth Street
Long Island City 1, N. Y.

The Pfaudler Co.
1000 West Avenue
Rochester 3, N. Y.

Pfister Chemical Wks.
Ridgefield, N. J.

Chas. Pfizer & Co., Inc.
630 Flushing Avenue
Brooklyn 6, N. Y.

Philadelphia Pump & Machinery Co., Inc.
Philadelphia, Pa.

Philadelphia Quartz Company
Public Ledger Building
Philadelphia 6, Pa.

Phillips Petroleum Company
Special Products Division
Bartlesville, Oklahoma

Photovolt Corp.
95 Madison Ave.
New York 16, N. Y.

Pioneer Latex & Chemical Co.
Middlesex, N. J.

Pittsburgh Coke and Chemical Company
Grant Building
Pittsburgh 19, Pa.

Plaskon
Barrett Div.
Allied Chemicals & Dye Corp.
40 Rector St.
New York, N. Y.

Plastics Color Company
233 Broad Street
Summit, N. J.

The Polymer Corp. of Pa.
Reading, Pa.

Popper & Sons, Inc.
300 Fourth Ave.
New York 10, N. Y.

The Pormix Corporation
2 Oak Ridge Street
Greenwich, Connecticut

Porous Plastic Filter Company
Glen Cove, N. Y.

Potters Brothers, Inc.
Carlstadt, N. J.

Pressed Steel Tank Company
West Allis Station
Milwaukee, Wis.

Price Varnish Co.
3rd & St. Louis
Valley Park, Mo.

Process Eng. & Mach. Company
Elizabeth, N. J.

Procter & Gamble
Cincinnati 1, Ohio

Promat Division
Poor & Company
851 South Market Street
Waukegan, Ill.

The Protectoseal Company
1920 South Western Avenue
Chicago 8, Illinois

Publicker Industries, Inc.
1429 Walnut Street
Philadelphia 2, Pa.

Pulverizing Machinery Company
Chatham Road
Summit, N. J.

Pyrene-C-O-Two
P.O. Box 390
Newark 1, N. J.

Q

The Quaker Oats Company
Merchandise Mart Plaza
Chicago 54, Illinois

R

RAM Chemicals
200 E. Olive Street
Gardena, Calif.

Ransburg Electro-Coating Corp.
Barth & Saunders Sts.
Indianapolis 7, Indiana

N. Ransohoff, Inc.
North Fifth St. at Ford Blvd.
Hamilton, Ohio

The Rapids-Standard Company, Inc.
Rapistan Bldg.
Grand Rapids 2, Mich.

Raybo Chemical Company
Huntington, West Virginia

The Raymond Corporation
Greene, N. Y.

R-B-H Dispersions
Interchemical Corp.
Bound Brook, New Jersey

Read Standard Corporation
Bakery Chemical Division
York, Pa.

Reichard-Coulston, Inc.
15 East 26th Street
New York 10, N. Y.

Reichhold Chemicals, Inc.
525 North Broadway
White Plains, N. Y.

Reilly Tar & Chemical Corporation
Merchants Bank Bldg.
Indianapolis 4, Indiana

Revolvator Company
North Bergen, N. J.

Reynolds Metals Company
Richmond, Virginia

Rheem Manufacturing Company
4361 Firestone Blvd.
South Gate, Calif.

Rhode Island Laboratories, Inc.
West Warwick, R. I.

Rhodia, Inc.
230 Park Avenue
New York 17, N. Y.

Sid Richardson Carbon Company
Fort Worth Club Bldg.
Fort Worth, Texas

W. C. Ritchie & Company
8802 Baltimore Avenue
Chicago 17, Ill.

H. H. Robertson Company
Pittsburgh, Pa.

Rockwell Manufacturing Co.
Pittsburgh 8, Pa.

Rohm & Haas Company
Washington Square
Philadelphia 5, Pa.

Charles Ross & Son Company
148-156 Classon Avenue
Brooklyn 5, N. Y.

Frank B. Ross Co., Inc.
Jersey City 4, N. J.

Ross & Rowe
50 Church St.
New York 4, N. Y.

Milton Roy Company
75 West Street
New York 6, N. Y.

Rubber Corp. of America
New South Road
Hicksville, L. I., N. Y.

S

St. Joseph Lead Company
250 Park Avenue
New York 17, N. Y.

Schenectady Varnish Co.
200 Congress Street
Schenectady 1, N. Y.

Claude B. Schneible Company
P.O. Box 81, North End Station
Detroit 2, Michigan

Schutte and Koerting Company
Cornwells Heights
Bucks County, Pa.

Schutz-O'Neill Company
307 Portland Avenue
Minneapolis 15, Minn.

Scientific Oil Compounding Co., Inc.
1637 South Kilbourn Avenue
Chicago 23, Ill.

Selas Corp. of America
Dresher, Pa.

Semet-Solvay Petrochemical Division
Allied Chemical & Dye Corp.
40 Rector Street
New York 6, N. Y.

George Senn, Inc.
2200 E. Westmoreland Street
Philadelphia 34, Pa.

Shannon Luminous Materials Co.
7356 Santa Monica Blvd.
Hollywood 46, Calif.

Sharples Chemicals Inc.
1100 Widener Bldg.
Philadelphia 7, Pa.

Shawinigan Resins Corp.
P.O. Box 2130
Springfield 2, Mass.

Sheffield Bronze Paint Corp.
17814 Waterloo Road
Cleveland 19, Ohio

Shell Chemical Corporation
380 Madison Avenue
New York 17, N. Y.

Shell Oil Company
50 W. 50th St.
New York 20, N. Y.

The Shepherd Chemical Co.
2803 Highland Avenue
Cincinnati 12, Ohio

Sherwin-Williams Company
115th Street & Cottage Grove Avenue
Chicago 28, Ill.

Silberline Mfg. Co., Inc.
Stamford, Conn.

Sill Industries
187 Maplewood Avenue
Maplewood, N. J.

Sinclair Chemicals, Inc.
6 East 45th Street
New York 17, N. Y.

Sindar Corporation
330 West 42nd Street
New York 36, N. Y.

Skelly Oil Company
605 West 47th Street
Kansas City 41, Missouri

Smico Inc.
25 NE 26th
Oklahoma City, Okla.

Smith Chemical & Color Co.
55 John Street
Brooklyn 1, N. Y.

J. Lee Smith & Co.
22 Ann Street
New York 38, N. Y.

Werner G. Smith, Inc.
1730 Train Avenue
Cleveland 13, Ohio

Snyder Chemical Corporation
Bethel, Connecticut

Socony Mobil Oil Co.
150 E. 42nd St.
New York, N. Y.

Solar Compounds Corp.
Linden, N. J.

Solvay Process Division
Allied Chemical & Dye Corp.
61 Broadway
New York 6, N. Y.

Solvents & Chemicals Group
2540 Fluornoy St.
Chicago 12, Ill.

Southern Electric Products
P.O. Box 406
Anderson, S. Car.

Southern Naval Stores
Columbia, Miss.

Sparkler Manufacturing Co.
Mundelein, Illinois

Sparta Industries
Station Road
Sparta, New Jersey

Spencer Kellogg and Sons, Inc.
Buffalo 5, N. Y.

D. R. Sperry & Company
808 Nepperhan Avenue
Yonkers, N. Y.

H. C. Spinks Clay Company Inc.
Paris, Tennessee

Standard Oil Company of Ohio
Cleveland, Ohio

Standard Ultramarine & Color Co.
Huntington, West Virginia

Star Welding & Mfg. Co., Inc.
1052-60 E. 134th Street
Cleveland 10, Ohio

K. A. Steel Chemicals Inc.
7450 Stony Island Avenue
Chicago 49, Ill.

Stein, Hall & Company, Inc.
285 Madison Ave.
New York, N. Y.

The Stepan Chemical Company
20 North Wacker Drive
Chicago 6, Illinois

Stephens-Adamson Mfg. Co.
Aurora, Ill.

Stern Can Company, Inc.
71 Locust Street
Boston 25, Mass.

The Stevenson Company
225-227 N. Wilkinson Street
Dayton 2, Ohio

Stewart-Warner Corporation
1826 Diversey Parkway
Chicago 14, Ill.

Fred'k A. Stresen-Reuter, Inc.
325 W. Main St.
Bensenville, Ill.

Strobridge Lithographing Company
Cincinnati 12, Ohio

Sturtevant Mill Company
2 Harrison Square
Boston 22, Mass.

The Sulzer-Waegner Co.
P.O. Box 703
Montvale, N. J.

Sun Oil Company
Philadelphia 3, Pa.

Sun Supply Company
10th Street & 44th Avenue
Long Island City 1, N. Y.

The Surety Rubber Company
Carrollton, Ohio

Swenson Associates
19120 W. McNichols Road
Detroit 19, Michigan

Swift & Company
1800 165th Street
Hammond, Indiana

Synthetic Chemicals Inc.
335 McClean Blvd.
Paterson, N. J.

Synthetic Products Company
1636 Wayside Road
Cleveland 12, Ohio

Syntron Company
Homer City, Pa.

Synvar Corporation
Wilmington, Delaware

T

Tamms Industries, Inc.
228 N. La Salle Street
Chicago 1, Ill.

Tennessee Products & Chemical Corporation
350 Fifth Avenue
New York 1, N. Y.

N. J. Thermex Co., Inc.
533 Bergen Street
Harrison, N. J.

The Thibaut & Walker Co., Inc.
150 Rome Street
Newark 1, N. J.

Thiokol Corporation
Trenton 7, New Jersey

Titanium Pigment Corporation
111 Broadway
New York 6, N. Y.

Towmotor Corporation
1226 E. 152nd Street
Cleveland 10, Ohio

Triangle Chemical Company
Foot of Elm Street
Macon, Georgia

Tri-Homo Corporation
Salem, Massachusetts

The Trippe Manufacturing Company
218 N. Jefferson Street
Chicago 6, Ill.

Trojan Powder Company
17 N. Seventh Street
Allentown, Pa.

Troy Chemical Company
2589 Frisby Avenue
New York 61, N. Y.

Troy Engine & Machine Co.
Troy, Pennsylvania

Turbo-Mixer
380 Madison Avenue
New York 17, N. Y.

U

Ultra Chemical Works, Inc.
Wood & Shady Streets
Paterson, N. J.

Ultrasonic Engineering Co.
P.O. Box 46
Maywood, Illinois

Union Bag-Camp Paper Corp.
233 Broadway
New York 7, N. Y.

Union Bay State Chemical Co., Inc.
491 Main Street
Cambridge 42, Mass.

United Carbon Company, Inc.
Charleston 27, West Virginia

U. S. Borax & Chemical Co.
630 S. Shatto Pl.
Los Angeles, Calif.

United States Bronze Powder Works, Inc.
220 West 42nd Street
New York 36, N. Y.

U. S. Coatings Co.
225 Manida Street
Bronx 59, N. Y.

U. S. Electrical Motors Inc.
Box 2058 Terminal Annex
Los Angeles 54, Calif.

U. S. Industrial Chemicals Company
420 Lexington Ave.
New York, N. Y.

U. S. Mica Company, Inc.
Jordan and VanDyke Streets
East Rutherford, N. J.

United States Steel Corporation
525 William Penn Place
Pittsburgh 30, Pa.

United States Steel Products
30 Rockefeller Plaza
New York 20, N. Y.

The U. S. Stoneware Company
Akron 9, Ohio

U. S. Testing Co., Inc.
1415 Park Avenue
Hoboken, N. J.

Universal Aviation Equipment, Inc.
362 Fifth Ave.
New York 1, N. Y.

Universal Chemicals Corporation
Lonsdale, R. I.

V

van Ameringen-Haebler, Inc.
521 West 57th Street
New York 19, N. Y.

R. T. Vanderbilt Co., Inc.
230 Park Avenue
New York 17, N. Y.

Vansul & Company
Englewood, New Jersey

Velsicol Chemical Corporation
330 East Grand Avenue
Chicago 11, Illinois

Viscatone Chemical Company
Ziegler, Ill

Vulcan Containers Inc.
Bellwood, Illinois

Vulcan Steel Container Company
Birmingham, Ala.

W

Warwick Wax Co., Inc.
10-10 44th Avenue
Long Island City 1, N. Y.

T. F. Washburn Company
2244 Elston Avenue
Chicago 14, Illinois

Watchemoket Optical Co., Inc.
232 W. Exchange Street
Providence 3, R. I.

West Virginia Pulp and Paper Company
Charleston, South Carolina

Western Machinery Company
760-766 Folsom Street
San Francisco 7, Calif.

Westvaco Chemical Division
Food Machinery & Chemical Corp.
161 E. 42nd Street
New York 17, N. Y.

White Color Card Company
467 Amsterdam
Detroit 2, Mich.

Whiting Corporation
Harvey, Illinois

Whittaker, Clark & Daniels, Inc.
260 West Broadway
New York 13, N. Y.

F. H. Wiessner, Inc.
Burlington, Vermont

Wilder Mfg. Co., Inc.
Mechanic St. & Erie RR
Port Jervis, N. Y.

A. R. Wilfley & Sons, Inc.
P.O. Box 2330
Denver, Colo.

C. K. Williams & Co.
640 N. 13th Street
Easton, Pennsylvania

Wilson Products, Inc.
Reading, Pa.

W. S. Wilson Corp.
11 S. William Street
New York 4, N. Y.

Wilson & Company
Wilson-Martin Division
Snyder Ave. & Swanson Street
Philadelphia 48, Pa.

Witco Chemical Company
122 E. 42nd Street
New York 17, N. Y.

Woburn Chemical Corporation (N. J.)
1200 Harrison Avenue
Harrison, N. J.

Worklon, Inc.
253 W. 28th Street
New York 1, N. Y.

Worthington Corporation
Harrison, N. J.

Wyandotte Chemicals Corporation
Wyandotte, Michigan

Z

G. S. Ziegler & Company
Great Neck Rd.
Great Neck, L. I., N. Y.

Zinsser & Co. Inc.
Sub. of Harshaw Chemical Co.
Hastings-on-Hudson, N. Y.

William Zinsser & Company
516 W. 59th St.
New York 19, N. Y.

Zophar Mills, Inc.
112-130 26th Street
Brooklyn 32, N. Y.

TRADE ASSOCIATIONS

NATIONAL PAINT, VARNISH and LACQUER ASSOCIATION
1500 Rhode Island Ave., N. W.
Washington 5, D. C.

FEDERATION of PAINT and VARNISH PRODUCTION CLUBS
121 South Broad St.
Philadelphia 7, Pa.

Air Pollution Control Association
4400 Fifth Avenue
Pittsburgh 13, Pa.

American Soybean Association
Hudson, Iowa

American Zinc Institute, Inc.
60 East 42nd Street
New York 17, N. Y.

The Asphalt Institute
801 Second Avenue
New York 17, N. Y.

Association of American Soap & Glyceride Producers, Inc.
295 Madison Avenue
New York 17, N. Y.

Copper & Brass Research Association
420 Lexington Avenue
New York 17, N. Y.

Environmental Equipment Institute
30 Church Street
New York 7, N. Y.

The Gummed Industries Association, Inc.
11 West 42nd Street
New York 36, N. Y.

Iodine Educational Bureau, Inc.
120 Broadway
New York, N. Y.

Institute of Industrial Health
University of Michigan
Ann Arbor, Michigan

Lead Industries Association
420 Lexington Avenue
New York 17, N. Y.

The Material Handling Institute, Inc.
813 Clark Building
Pittsburgh 22, Pa.

Metal Powder Association
420 Lexington Avenue
New York 17, N. Y.

National Barrel and Drum Assoc., Inc.
1145 19th St., N. W.
Washington 6, D. C.

The Naphthenate Preservatives Institute, Inc.
517 Wyatt Building
Washington 5, D. C.

Natural Rubber Bureau
1631 K Street, N.W.
Washington 6, D. C.

The National Tung Oil Marketing Cooperative, Inc.
302 Magazine Street
New Orleans 12, La.

Paint Research Institute T.N.O.
Rijswijk (Z.H.), Netherlands

Shellac Information Bureau
65 Pine Street
New York 5, N. Y.

Steel Shipping Container Institute, Inc.
600 Fifth Avenue
New York 20, N. Y.

Steel Structures Painting Council
4400 Fifth Avenue
Pittsburgh 13, Pa.

The Tall Oil Association
122 East 42nd Street
New York 17, N. Y.

Tin Research Institute Inc.
492 West Sixth Avenue
Columbus 1, Ohio

Wet Ground Mica Association
420 Lexington Avenue
New York 17, N. Y.

PRODUCTS LISTING

RESINS

Acrylics

American Cyanamid Co., Organic Chemicals Div.
Borden Co., Chemical Div.
E. I. duPont de Nemours and Co.
General Aniline & Film Corp.
Naugatuck Chemical Div., U. S. Rubber Co.
Rohm & Haas Co.

Alkyds

Alkydol Laboratories
American Cyanamid Co., Plastics & Resins Div.
Archer-Daniels-Midland Co.
Barrett Div. (Plaskon), Allied Chemical & Dye Corp.
California Ink Co., Inc.
Cambridge Industries Co.
Cargill, Inc.
Crosby Chemicals
Crownoil Chemical Co.
Farac Oil & Chemical Co.
Farnow, Inc.
Freeman Chemical Corp.
Hercules Powder Co.
Hilton-Davis Chemical Co.
Jones-Dabney Co.
McCloskey Varnish Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.
Schenectady Varnish Co.
Sherwin-Williams Co.
Thibaut & Walker Co., Inc.
U. S. Coatings Corp.
T. F. Washburn Co.

Cellulosics

Dow Chemical Co.
E. I. du Pont de Nemours & Co.
Eastman Chemical Products, Inc.
Hercules Powder Co.

Chlorinated Rubber

Hercules Powder Co.

Coumarone-Indene

Barrett Div., Allied Chemical & Dye Corp.
Neville Chemical Co.
Pennsylvania Industrial Chemical Corp.

Cyclized Rubber

Goodyear Tire & Rubber Co., Inc.

Cyclopentadiene

R-B-H Dispersions, Div. of Interchemical Corp.

Epoxy

Bakelite Co.
Ciba Co., Inc.
Freeman Chemical Corp.
Jones-Dabney Co.
Reichhold Chemicals, Inc.
Schenectady Varnish Co.
Shell Chemical Corp.
Sherwin-Williams Co.

Epoxy Esters

McCloskey Varnish Co.
T. F. Washburn Co.

Ester Gum Solutions

Alkydol Laboratories, Inc.
Crosby Chemicals, Inc.
Crownoil Chemical Co.
Glidden Co.
Hercules Powder Co.
C. J. Osborn Co.
Pine Chemicals, Inc.
Reichhold Chemicals, Inc.

Fumaric

Alkydol Laboratories, Inc.
Filtered Rosin Products, Inc.
C. J. Osborn Co.
Reichhold Chemicals, Inc.
Schenectady Resins

Hydrocarbons

Alkydol Laboratories, Inc.
American Gilsonite Co.
Amoco Chemicals Corp.
Cosden Petroleum Corp.
Koppers Co., Tar Products Div.
Neville Chemical Co.
Pennsylvania Industrial Chemical Corp.
R-B-H Dispersions, Div. of Interchemical Corp.
Velsicol Chemical Corp.
G. S. Ziegler & Co.

Isocyanates

Carwin Co.
E. I. du Pont de Nemours Co.
Mobay Chemical Co.
National Aniline Div., Allied Chemical & Dye Corp.

Melamines

American Cyanamid Co., Plastics & Resins Div.
Barrett Div. (Plaskon), Allied Chemical & Dye Corp.
Monsanto Chemical Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.

Maleics

Alkydol Laboratories, Inc.
Barrett Div. (Plaskon), Allied Chemical & Dye Corp.
Crosby Chemicals, Inc.
Crownoil Chemical Co.
Hercules Powder Co.
Jones-Dabney Co.
Naugatuck Chemical Div., U. S. Rubber Co.
C. J. Osborn Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.
Schenectady Varnish Co.
Sherwin-Williams Co.

Natural Resins

Acme Shellac Products Co.
Gillespie-Rogers-Pyatt Co., Inc.
Haeuser Shellac Co.
Hercules-Powder Co.
Heyden-Newport
O. G. Innes Corp.
Internatio-Rotterdam
Reichhold Chemicals, Inc.
Thibaut & Walker Co., Inc.
William Zinsser & Co.

Nitrocellulose Solutions

Cellofilm Industries, Inc.

Phenolics

Alkydol Laboratories, Inc.
American Cyanamid Co., Plastics & Resins Div.
Bakelite Co.
Barrett Div. (Plaskon), Allied Chemical & Dye Corp.
Crownoil Chemical Co.
Farnow, Inc.
General Electric Co., Chemical & Metallurgical Div.

Hercules Powder Co.
Krumbhhar Chemicals, Inc.
McCloskey Varnish Co.
Monsanto Chemical Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.
Schenectady Varnish Co.
Varcum Chemical Corp.

Polyamides

General Mills, Inc.

Polybutenes

Advance Solvents & Chemical Corp.
Amoco Chemicals Corp.
Cosden Petroleum Corp.
Naftone, Inc.

Polyesters

Alkydol Laboratories, Inc.
American Cyanamid Co., Plastics & Resins Div.
Archer-Daniels-Midland Co.
Atlas Powder Co.
Bakelite Co.
Barrett Div. (Plaskon), Allied Chemical & Dye Corp.
Freeman Chemical Corp.
Mobay Chemical Co.
Naugatuck Chemical Div., U. S. Rubber Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.
Schenectady Varnish Co.

Polystyrenes

Bakelite Co.
Dow Chemical Co.
Koppers Co.
Marbon Chemical, Div. of Borg-Warner
Monsanto Chemical Co.
Naugatuck Chemical Div., U. S. Rubber Co.
Pennsylvania Industrial Chemical Corp.

Silicones

Dow Corning Corp.
General Electric, Chemical Materials Dept.
Linde Air Product Co., Div. Union Carbide & Carbon Corp.

Styrene Copolymers

Bakelite Corp.
Dewey & Almy Chemical Co.
General Tire & Rubber Co.
B. F. Goodrich Chemical Co.
Goodyear Tire & Rubber Co., Inc., Chemical Div.
Koppers Co.
Naugatuck Chemical Div., U. S. Rubber Co.

Terpenes

Crosby Chemical
Hercules Powder Co.
Pennsylvania Industrial Chemical Corp.
Schenectady Varnish Co.

Thixotropic Vehicles

T. F. Washburn Co.

Ureas

American Cyanamid Co., Plastics & Resins Dept.
Barrett Div. (Plaskon), Allied Chemical & Dye Corp.
Jones-Dabney Co.
Monsanto Chemical Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.
Sherwin-Williams

Vinyls

Bakelite Co.
Borden Co., Chemical Div.
Colton Chemical Co.
Dow Chemical Co.
E. I. du Pont de Nemours & Co.
Firestone Plastics Co., Div. of Firestone Tire & Rubber Co.
General Aniline & Film Corp.
B. F. Goodrich Chemical Co.
Goodyear Tire & Rubber Co., Inc.
Monsanto Chemical Co.
National Starch Products, Inc.
Naugatuck Chemical Div., U. S. Rubber Co.
Reichhold Chemicals, Inc.
Shawinigan Resins Corp.

LATEX EMULSIONS

Acrylic

Rohm & Haas Co.
Union Bay State Chemical Co.

Interpolymer Type

Monsanto Chemical Co.

Latex Base

Naftone

Polystyrene Emulsions

Bakelite Co.
Dow Chemical Co.
Koppers Co., Inc., Chemical Div.
Monsanto Chemical Co.
Union Bay State Chemical Co.

Polyvinyl Acetate Emulsions

Bakelite Co.
Borden Co.
Calvert-Mount Winans
Celanese Corp. of America (Plastics)
Colton Chemical Co.
Crownoil Chemical Co.
Dewey & Almy Chemical Co.
E. I. du Pont de Nemours & Co., (Electrochemical Dept.)
Jones-Dabney Co.
Morningstar Nicol
National Starch Products, Inc.
Nopco Chemical Co.
Paisley Products
Shawinigan Resins Corp.
Reichhold Chemicals, Inc.
U. S. Rubber Co., Naugatuck Chemical Div.
R. T. Vanderbilt Co.

Styrene-Butadiene

Dewey & Almy Chemical Co.
Borden Co.
Dow Chemical Co.
Firestone Plastics Co.
General Tire & Rubber Co., Chemical Div.
Goodyear Tire & Rubber Co., Inc., Chemical Div.
Koppers Co., Inc., Chemical Div.
U. S. Rubber Co., Naugatuck Chemical Div.

Synthetic Types

California Ink Co., Inc.
Pioneer Latex & Chemical Co.

Vinylidene Chloride

Dow Chemical Co.

Miscellaneous Types

Archer-Daniels-Midland
Cargill, Inc.
Alfred Hague & Co.
Pennsylvania Industrial Chemicals

PIGMENTS

Whites

American Cyanamid Co., Pigment Div.
American Zinc Sales Co.
Chemical & Pigment Co.
E. I. du Pont de Nemours & Co.
Eagle-Picher Co.
Glidden Co.
New Jersey Zinc Co.
St. Joseph Lead Co.
Sherwin-Williams Co., Pigment, Color and Chemical Div.
Titanium Pigment Corp.

Blacks

Acheson Colloids Co.
Godfrey L. Cabot, Inc.
Columbian Carbon Co.
General Carbon Co.
Harshaw Chemical Co.
J. M. Huber Corp.
H. Kohnstamm
Mineral Pigments Corp.

Reichard-Coulston, Inc.
Sid Richardson Carbon Co.
Shepherd Chemical Co.
Smith Chemical & Color Co.
J. Lee Smith & Co.
R. T. Vanderbilt Co.
C. K. Williams & Co.
Witco Chemical Co.

Inorganic

Blues

Eagle-Picher Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
Standard Ultramarine & Color Co.
Whittaker, Clark & Daniels, Inc.

Browns & Tans

Columbian Carbon Co.
Mineral Pigments Corp.
Reichard-Coulston, Inc.
Smith Chemical & Color Co.
J. Lee Smith & Co.
C. K. Williams & Co.

Greens

Glidden Co.
Imperial Paper & Color Corp.
Mineral Pigment Corp.
C. K. Williams & Co.
Kentucky Color & Chemical Co.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
Smith Chemical & Color Co.
Standard Ultramarine & Color Co.

Oranges

Climax Molybdenum Co.
E. I. du Pont de Nemours & Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
Mineral Pigments Corp.
Sherwin-Williams Co., Pigment, Color & Chemical Div.

Reds & Maroons

Columbian Carbon Co.
Eagle-Picher Co.
Glidden Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
Mineral Pigment Corp.
Reichard-Coulston, Inc.
Smith Chemical & Color Co.
J. Lee Smith & Co.
C. K. Williams & Co.

Yellows

Columbian Carbon Co.
E. I. du Pont de Nemours & Co.
Glidden Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
Mineral Pigments Corp.
Reichard-Coulston, Inc.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
Smith Chemical & Color Co.
J. Lee Smith & Co.
Whittaker, Clark & Daniels, Inc.
C. K. Williams & Co.

Organic

Blues

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
E. I. du Pont de Nemours & Co.
Federal Color Laboratories, Inc.
Fine Color Co.
General Dyestuff Corp.
B. F. Goodrich Chemical Co., Harmon Colors
Harshaw Chemical Co.
Imperial Paper & Color Corp.
H. Kohnstamm
Kentucky Color & Chemical Co.
Mineral Pigments Corp.
Pittsburgh Coke & Chemical Co.
Shepherd Chemical Co.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
Standard Ultramarine & Color Co.

Browns & Tan

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
Fine Colors
General Dyestuff Corp.
B. F. Goodrich Chem. Co., Harmon Colors
Harshaw Chemical Co.
Hilton-Davis Chemical Co.
H. Kohnstamm & Co.
Sherwin-Williams Co.

Greens

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
E. I. du Pont de Nemours & Co.
Federal Color Laboratories, Inc.
General Dyestuff Corp.
B. F. Goodrich Chemical Co., Harmon Colors
Harshaw Chemical Co.
Hilton-Davis Chemical Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
H. Kohnstamm & Co.
Mineral Pigments Corp.
Pittsburgh Coke & Chemical Co.
Shepherd Chemical Co.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
Standard Ultramarine & Color Co.

Oranges

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
General Dyestuff Corp.
B. F. Goodrich Chemical Co., Harmon Colors
Hilton-Davis Chemical Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
Mineral Pigments Corp.
Standard Ultramarine & Color Co.

Reds & Maroons

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
E. I. du Pont de Nemours & Co.
Federal Color Laboratories, Inc.
Fine Color Co.
General Dyestuff Corp.
B. F. Goodrich Chemical Co., Harmon Colors
Harshaw Chemical Co.
Hilton-Davis Chemical Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
H. Kohnstamm & Co.
Mineral Pigments Corp.
Shepherd Chemical Co.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
Standard Ultramarine & Color Co.

Yellows

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
E. I. du Pont de Nemours & Co.
Federal Color Laboratories, Inc.
Fine Colors Co
General Dyestuff Corp.
B. F. Goodrich Chemical Co., Harmon Colors
Harshaw Chemical Co.
Hilton-Davis Chemical Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
H. Kohnstamm & Co.
Mineral Pigments Corp.
Shepherd Chemical Co.
Standard Ultramarine & Color Co.

Lakes & Toners

American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
Collway Colors, Inc.
E. I. du Pont de Nemours & Co.
Fine Colors Co.
General Dyestuff Corp.
B. F. Goodrich Chemical Co., Harmon Colors
Harshaw Chemical Co.
Hilton-Davis Chemical Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
H. Kohnstamm & Co.
Mineral Pigments Corp.
Magruder Color Co., Inc.
Pittsburgh Coke & Chemical Co.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
Standard Ultramarine & Color Co.

Dispersions

Acheson-Colloids Co.
American Cyanamid Co., Pigment Div.
Ansbacher-Siegle Corp.
California Ink Co., Inc.
Carbon Dispersions, Inc.
Claremont Dispersion
Columbian Carbon Co.
B. F. Goodrich Chemical Co., Harmon Colors
Goodyear Tire & Rubber Co., Inc., Chemical Div.
Harshaw Chemical Co.
Harwick Standard Chemical Co.
Hilton-Davis Chemical Co.
Imperial Paper & Color Corp.
Kentucky Color & Chemical Co.
H. Kohnstamm
Kromall Chemical & Dispersions Corp.
Pennsylvania Color & Chemical Co.

R-B-H Dispersions, Div. of Interchemical Corp.
Sherwin-Williams Co., Pigment, Color & Chemical Div.
J. Lee Smith & Co.
Thibaut & Walker Co., Inc.
Whittaker, Clark & Daniels, Inc.

Metallic

Aluminum Pastes & Powders

Aluminum Co. of America
Magna Mfg. Co.
Metals Disintegrating Co.
Reynolds Metals
Siberline Manufacturing Co., Inc.

Bronze Powders

Aluminum Co. of America
Magna Mfg. Co.
Metals Disintegrating

Brown

Smith Chemical & Color Co.

Green Gold Type

E. I. du Pont de Nemours & Co.

Zinc Dust

New Jersey Zinc Co.

Extenders & Fillers

Godfrey L. Cabot, Inc.
Carbola Chemical Co., Inc.
Chemical & Pigment Co.
Concord Mica Corp.
De Lore Div., National Lead Co.
Georgia Kaolin Co.
Great Lakes Carbon Corp.
Hayden Mica Co.
J. M. Huber Corp.
Johns-Manville
Marine Magnesium Div., Merck & Co.
Minerals & Chemicals Corp. of America
Sherwin-Williams Co.
Smith Chemical & Color Co.
Tamms Industries, Inc.
Tennessee Products & Chemical Corp.
R. T. Vanderbilt Co.
Whittaker, Clark & Daniels, Inc.
C. K. Williams & Co.
Witco Chemical Co.
Wyandotte Chemicals Corp.

Fluorescent

Canadian Radium & Uranium Corp.
General Dyestuff Corp.
Imperial Paper & Color Co.
Shannon Luminous Materials Co.
New Jersey Zinc Sales Co.

Flush Colors

American Cyanamid Pigment Div.
Ansbacher-Siegle Corp.
Federal Color Laboratories, Inc.
General Dyestuff Corp.
Harwick Standard Chemical Co.
Hilton-Davis Chemical Co.
Holland Color & Chemical Co.
Sherwin-Williams Co.
Standard Ultramarine & Color Co.
Whittaker, Clark & Daniels, Inc.

Umbers & Siennas

Mineral Pigments Corp.
Smith Chemical & Color Co.
J. Lee Smith & Co.
Reichard-Coulston, Inc.
C. K. Williams & Co.

DRYING OILS

Castor Oils

Baker Castor Oil Co.
Brazilian Industrial Oils, Inc.
Pacific Vegetable Oil Corp.
Sherwin-Williams Co.
Spencer Kellogg & Sons, Inc.
Woburn Chemical Corp.

Coconuts

Cargill, Inc.
E. F. Drew & Co.
Emery Industries, Inc.
Glidden Co.
Pacific Vegetable Oil Corp.
Spencer Kellogg & Sons, Inc.

Cotton Seed

Armour Chemical Div.
E. F. Drew & Co.
Emery Industries, Inc.
Spencer-Kellogg & Sons

Dicyclopentadiene Copolymers

Spencer Kellogg & Sons, Inc.

Fish Oils

Archer-Daniels-Midland Co.
Cargill, Inc.
Crownoil Chemical Co.
T. F. Goudy Co.
Werner G. Smith, Inc.

Linseed Oils

Archer-Daniels-Midland Co.
Cargill, Inc.
T. F. Goudy Co.
Spencer Kellogg & Sons, Inc.
Minnesota Linseed
Sherwin-Williams Co.
G. S. Ziegler & Co.

Oiticica

Brazil Oiticica, Inc.
Brazilian Industrial Oils, Inc.
Pacific Vegetable Oil Corp.

Petroleum Drying Oils

Enjay Co.
Sun Oil Co.
Safflower
Pacific Vegetable Oil Corp.

Soybean Oils

Archer-Daniels-Midland Co.
Cargill, Inc.
Crownoil Chemical Co.
E. F. Drew
Emery Industries, Inc.
Glidden Co.
General Mills
Spencer Kellogg & Sons, Inc.
Pacific Vegetable Oil Corp.
A. E. Staley Mfg. Co.
G. S. Ziegler & Co.

Styrenated Oils

Spencer Kellogg & Sons, Inc.

Tall Oils

Arizona Chemical Co.
Farac Oil & Chemical Co.
T. F. Goudy Co.
Kraft Chemical Co.
Hercules Powder Co.
Heyden-Newport
Werner G. Smith, Inc.
Union Bag & Paper Corp.
West Virginia Pulp & Paper Co.
G. S. Ziegler & Co.

Tung Oils

Internatio-Rotterdam
Werner G. Smith, Inc.

FATTY ACIDS, ESTERS AND DERIVATIVES

Antara Chemical Div.
Archer-Daniels-Midland Co.
Armour Chemical Div.
Atlas Powder Co.
Baker Castor Oil Co.
Crosby Chemical Co.
E. F. Drew & Co.
Emery Industries
General Mills, Chemical Div.
Glyco Products Co.
A. Gross & Co.
Harchem Div., Wallace & Tiernan, Inc.
Nopco Chemical Co.
Solvents and Chemicals Group
Swift & Co.
Woburn Chemical Corp.
G. S. Ziegler Co.

INTERMEDIATES

Anhydrides & Acids

Adipic Acid

E. I. du Pont de Nemours & Co.
Monsanto Chemical Co.
National Aniline Div., Allied Chemical & Dye Corp.

Benzoic Acids

Heyden-Newport
Mallinckrodt Chemical Works
Merck & Co.
Monsanto Chemical Co.

Di & Polybasic Acids

Emery Industries, Inc.
Heyden-Newport
National Aniline Div., Allied Chemical & Dye Corp.
U. S. Industrial Chemicals Co.

Dodencenylsuccinic Anhydrides
National Aniline Div., Allied Chemical & Dye Corp.

Fumaric Acids
Chas. Pfizer & Co., Inc.
Pittsburgh Coke & Chemical Co.
Monsanto Chemical Co.
National Aniline Div., Allied Chemical & Dye Corp.

Hexahydrophthalic Anhydrides

National Aniline Div., Allied Chemical & Dye Corp.

Isophthalic Anhydrides
Oronite Chemical Co.

Maleic Anhydrides
American Cyanamid Co., Industrial Chemical Div.
Barrett Div., Allied Chemical & Dye Corp.
Carbide & Carbon Chemicals Co.
Monsanto Chemical Co.
National Aniline Div., Allied Chemical & Dye Corp.
Pittsburgh Coke & Chemical Co.
Reichhold Chemicals, Inc.

Naphthenic Acid
Enjay Co.
Gulf Oil
Oronite Chemical Co.
Sun Oil Co.

Phthalic Anhydrides

American Cyanamid Co., Industrial Chemical Div.
Barrett Div., Allied Chemical & Dye Corp.
Koppers Co., Inc., Chemical Div.
Mallinckrodt Chemical Works
Monsanto Chemical Co.
National Aniline Div., Allied Chemical & Dye Corp.
Oronite Chemical Co.
Pittsburgh Coke & Chemical Co.
Reichhold Chemicals, Inc.

Succinic Acids

National Aniline Div., Allied Chemical & Dye Corp.

Tetrahydrophthalic Anhydrides

National Aniline Div., Allied Chemical & Dye Corp.

Polyols

Butenediol
General Aniline & Film Corp.

Glycerine

Dow Chemical Co.
E. F. Drew
Glycerine Corp. of America
A. Gross & Co.
Lever Bros.
Mallinckrodt Chemical Works
Procter & Gamble
Shell Chemical Corp.
Solvents & Chemical Group
Swift & Co.

Pentaerythritols (Di & Tri)
Celanese Corp. of America
Commercial Solvents Co.
Delaware Chemicals
T. F. Goudy
Hercules Powder Co.
Heyden-Newport
Charles A. Koons
Reichhold Chemicals, Inc.
Trojan Powder Co.

Polyhydroxy Resin
Dow Chemical Co.

Sorbitol
Atlas Powder Co.
Merck & Co.

Trimethyloethane
Heyden-Newport
Trojan Powder Co.

Trimethylopropane
Heyden-Newport
Trojan Powder Co.

Miscellaneous

Alpha Methylstyrene
Dow Chemical Co.

Bisphenol A
Dow Chemical Co.

Divinylbenzene
Dow Chemical Co.
Koppers Co.

Epichlorohydrin
Carbide & Carbon Chemical Co.
Dow Chemical Co.
Shell Chemical Corp.

Formaldehyde
American Cyanamid Co., Industrial Chemical Div.
Borden Co., Chemical Div.
Celanese Corp. of America
Commercial Solvents Corp.
Heyden-Newport
Mallinckrodt Chemical Works
Monsanto Chemical Co.
Nitrogen Div., Allied Chemical & Dye Corp.
Olin Mathieson Chemical Corp.
Reichhold Chemicals, Inc.

Hexmethylenetetramine
Borden Chemical Co., Chemical Div.
E. I. du Pont de Nemours & Co.
Heyden-Newport
Mallinckrodt Chemical Works
Olin Mathieson Chemical Corp.

Methyl Esters
General Mills, Inc.

Glycols (Ethylene Etc.)
Barrett Div., Allied Chemical & Dye Corp.
Carbide & Carbon Chemical Co.
Celanese Corp. of America
Dow Chemical Co.
Merck & Co.
Shell Chemical Corp.
Solvents & Chemical Group

Methyl Glucoside
Corn Products Refining Co.

Phenols

American Cyanamid Co., Organic Chemical Div.
Barrett Div.
Carbide & Carbon Chemical Co.
Koppers Co.
Mallinckrodt Chemical Works
Monsanto Chemical Co.
Oronite Chemical Co.
Pittsburgh Coke & Chemical Co.
Reichhold Chemicals, Inc.

Resorcinol
Heyden-Newport
Koppers Co.
Mallinckrodt Chemical Works
Reichhold Chemicals, Inc.
Rohm & Haas Co.

Styrene Monomer

Carbide & Carbon Chemical Co.
Dow Chemical Co.
Koppers Co.
Monsanto Chemical Co.

Tar Bases & Acids

Barrett Div., Allied Chemical & Dye Corp.
Koppers Co.
Pittsburgh Coke & Chemical Co.

Ureas

E. I. du Pont de Nemours & Co.
Grace Chemical Co., Div. of W. R. Grace & Co.
Monsanto Chemical Co.

Vinyltoluene

Dow Chemical Co.

Rosin & Terpene Chemicals

Godfrey L. Cabot
Crosby Chemical Co.
Dixie Pine Products
Glidden Co.
Hercules Powder Co.
Heyden-Newport
National Rosin Oil Products
Reichhold Chemicals, Inc.
Solvents and Chemicals Group
Southern Naval Stores
West Virginia Pulp & Paper Co.
G. S. Ziegler & Co.
Zophar Mills

SOLVENTS

Aliphatics
American Mineral Spirits Co.
R. J. Brown Co.
Continental Oil Co.
Eastern States Chemical Corp.
Esso Standard Oil Co.
Fallek Products Co.
Penola Oil Co.
Shell Oil Co.
Skelly Oil Co.
Solvents and Chemicals Group
Standard Oil Co. of Ohio

Aromatics

American Mineral Spirits Co.
Anderson-Prichard Oil Corp.
Barrett Div., Allied Chemical & Dye Corp.
R. J. Brown Co.
Cosden Petroleum Corp.
Dow Chemical Co.
Eastern States Chemical Corp.
Esso Standard Oil Co.
Fallek Products Co.
Neville Chemical Co.
Pittsburgh Coke & Chemical Co.
Penola Oil Co.
Shell Oil Co.
Sinclair Chemicals, Inc.
Solvents and Chemicals Group
Sun Oil Co.
United States Steel Corp.
Velsicol Chemical Corp.

Halogen-Containing

Columbia-Southern Chemical Corp.
Diamond Alkali Co.
Dow Chemical Co.
E. I. du Pont de Nemours & Co.
Kolker Chemical Corp.
Olin Mathieson Chemical Corp.
Solvents and Chemicals Group
Wyandotte Chemical Corp.

Naphthas

Eastern States Chemical Corp.
Esso Standard Oil Co.
Penola Oil Co.
Pittsburgh Coke & Chemical Co.
Shell Oil Co.
Sinclair Chemicals, Inc.
Skelly Oil Co.
Solvents & Chemicals Group
Standard Oil Co. of Ohio

Nitroparaffins

Commercial Solvents Corp.

Odorless

American Mineral Spirits Co.
Anderson-Prichard Oil Corp.
R. J. Brown Co.
Phillips Petroleum Co.
Shell Oil Co.
Sinclair Chemicals, Inc.
Socony Mobil Oil Co., Inc.
Standard Oil Co. of Ohio

Oxygen-Containing

Barrett Div., Allied Chemical & Dye Corp.
Carbide & Carbon Chemical Co.
Celanese Corp. of America, Chemical Div.
Commercial Solvents Corp.
Eastman Chemical Products ,Inc.
E. I. du Pont de Nemours & Co.
Hercules Powder Co.
National Aniline Div., Allied Chemical & Dye Corp.
Pennsylvania Salt Manufacturing Co., Industrial Div.
Publicker Industries, Inc.
Solvents & Chemicals Group
Shell Chemical Corp.
George Senn, Inc.
U. S. Industrial Chemicals Co.

Turpentines

Godfrey L. Cabot
Crosby Chemicals, Inc.
Glidden Co.
Guignon & Green, Inc.
Hercules Powder Co.
Heyden-Newport
Pine Chemicals, Inc.
Sherwin-Williams Co.
Solvents and Chemicals Group
Southern States Chemical Co.

PLASTICIZERS

Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Archer-Daniels-Midland Co.
Armour Chemical Div.
Atlas Powder Co.
Baker Castor Oil Co.
Barrett Div., Allied Chemical & Dye Corp.
Godfrey L. Cabot, Inc.
Cambridge Industries Co., Inc.
Carbide & Carbon Chemical Co.
Celanese Corp. of America, Chemical Div.
Commercial Solvents Corp.
Diamond Alkali Co.
E. F. Drew & Co.
Eastman Chemical Products, Inc.
Emery Industries, Inc.
B. F. Goodrich Chemical Co.
Harchem Div., Wallace & Tierman Co.
Harwich Standard Chemical
Hercules Powder Co.
Kolker Chemical Corp.
Monsanto Chemical Co.
Naftone, Inc.
Neville Chemical Co.
Ohio-Apex Div., Food Machinery & Chemical Corp.
Pennsylvania Industrial Chemical Co.
Chas. Pfizer & Co., Inc.
Pittsburgh Coke & Chemical Co.
Reichhold Chemicals, Inc.
Rohm & Haas Co.
The Solvents and Chemical Group
Tennessee Products & Chemical Corp.
Witco Chemical Co.
G. S. Ziegler & Co.

ADDITIVES

Anti-Foaming Agents

American Cyanamid Co., Organic Chemical Div.
Antara Chemicals
Carbide & Carbon Chemicals Co.
Dow Corning Corp.
E. I. du Pont de Nemours & Co.
General Electric Co., Silicone Products Dept.
Glyco Products Co., Inc.
Synthetic Chemicals, Inc.

Anti-Floating Agents

Dow Corning Corp.
General Electric Co., Silicone Products Dept.
Imperial Paper & Color Corp.
Troy Chemical Co.

Anti-Livering Agents

Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Pennsylvania Salt Mfg. Co., Industrial Div.

Anti-Flooding Agents

Advance Solvents & Chemical Corp.
American Lecithin Co.
Baker Castor Oil
Dow Corning Corp.
Linde Air Products Co., Div. of Union Carbide & Carbon Corp.
Minerals & Chemicals Corp. of America
Nopco Chemical Co.
Raybo Chemical Co.
Synthetic Chemicals, Inc.

Anti-Sagging Agents

Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Baker Castor Oil Co.
Raybo Chemical Co.
Troy Chemical Co.

Anti-Settling Agents

Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Godfrey L. Cabot, Inc.
Baker Castor Oil Co.
W. H. Fales Co.
Fallek Products Co.
Naftone, Inc.
Troy Chemical Co.

Anti-Skinning Agents

Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Naftone, Inc.
National Aniline Div., Allied Chemical & Dye Corp.
Neville Chemical Co.
Nuodex Products Co.
Pennsylvania Salt Mfg. Co., Industrial Div.
Raybo Chemical Co.
Sindar Corp.
Synthetic Chemicals, Inc.
Troy Chemical Co.

Bactericides

Buckman Laboratories, Inc.
Metalsalts Corp.

Bodying Agents

Baker Castor Oil Co.
Nuodex Products Co.
Raybo Chemical Co.
Ross & Rowe, Inc.
Troy Chemical Co.

Carboxymethylcellulose
Dow Chemical Co.
Hercules Powder Co.

Chlorinated Paraffin
Bakelite Co.
Diamond Alkali Co.

Corrosion Inhibitor
Tennessee Products & Chemical Corp.

Curing Agents
National Aniline Div., Allied Chemical & Dye Corp.

Deodorants
Aromatic Products
Polak & Schwartz
Rhodia, Inc.
Sindar Corp.
van Ameringen-Haebler, Inc.

Dispersing Agents
Air Reduction Chemical Co.
American Cyanamid Co.
American Lecithin Co.
Antara Chemical Div.
Armour Chemical Div.
Atlantic Refinery Co.
Atlas Powder Co.
Godfrey L. Cabot
Carbide & Carbon Chemical Co.
Commercial Solvents Corp.
Geigy Industrial Chemical Div.
Glyco Products Co.
Johns-Manville
Minerals & Chemicals Corp. of America
National Aniline Div., Allied Chemical & Dye Corp.
Nopco Chemical Co.
Nuodex Products Co.
Raybo Chemical
Troy Chemical
R. T. Vanderbilt Co.
Wyandott Chemicals Corp.

Driers
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
California Ink Co., Inc.
Ferro Chemical Corp.
Harshaw Chemical Co.
McCloskey Varnish Co.
Naftone, Inc.
Nuodex Products Co.
Oronite Chemical Co.
Shepherd Chemical Co.
Fred'k A. Stresen-Reuter
Witco Chemical Co.

Drying Accelerators
R. T. Vanderbilt Co.

Dyes For Stains
National Aniline Div., Allied Chemical & Dye Corp.

Emulsifiers
Advance Solvents & Chemical Corp.
Air Reduction Chemical Co.
American Cyanamid Co., Organic Chemical Div.
American Lecithin Co.
Antara Chemical Div.
Atlantic Refining Co.
Atlas Powder Co.
Carbide & Carbon Chemical Co.
Fallek Products Co.
Geigy Industrial Chemical Div.
Glyco Products Co.
Minerals & Chemicals Corp. of America
Mona Industries
National Aniline Div., Allied Chemical & Dye Corp.
Nopco Chemical Co.
Olin Mathieson Chemical Corp.
Pennsylvania Salt Mfg. Co., Industrial Div.
Raybo Chemical Co.
Ross & Rowe
A. E. Staley Mfg. Co.
Stepan Chemical Co.
Synthetic Chemicals Co.
Witco Chemical Corp.
Wyandotte Chemicals Corp.

Flatting Agents
Godfrey L. Cabot
Davison Chemical Co., Div. of W. R. Grace & Co.
Dow Corning Corp.
Dicalite Div.
Great Lakes Carbon Corp.
Glyco Products Co.
J. M. Huber Corp.
Johns-Manville
Minerals & Chemicals Corp. of America
Nopco Chemical Co.
Whittaker, Clark & Daniels

Flow Controlling Agents
Dow Corning Corp.
Jones-Dabney Co.
R. T. Vanderbilt Co.

Fungicides
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Antara Chemical Div.
Buckman Laboratories, Inc.
Dow Chemical Co.
E. I. du Pont de Nemours & Co.
Ferro Chemical Corp.
Gallowhur Chemical Corp.
Heyden-Newport
Metalsalts Corp.
Naftone, Inc.
Nuodex Products Co.
Scientific Oil Compounding Co.
Troy Chemical Co.
R. T. Vanderbilt Co.
Witco Chemical Corp.

Gloss Improver
Dow Corning Corp.

Grinding Aids
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
General Aniline & Film Corp.
Nuodex Products Co.
Ross & Rowe
Synthetic Chemicals, Inc.
Troy Chemical Co.

Inhibitors
Nuodex Products Co.

Latex Additives
Naftone, Inc.

Lecithin
American Lecithin Co., Inc.
Naftone, Inc.
A. E. Staley Mfg. Co.
Ross & Rowe, Inc.

Masking Agents
Aromatic Products Co.
Pollak & Schwartz
Sindar Corp.
van Ameringen-Haebler, Inc.

Masonry Water Repellents
Dow Corning Corp.
General Electric Co.

Metal Cleaners
Pennsylvania Salt Mfg. Co., Industrial Div.

Mildewcides
Advance Solvents & Chemical Corp.
Antara Chemicals
Buckman Laboratories, Inc.
Dow Chemical Co.
E. I. du Pont de Nemours & Co., Inc.
Gallowhur

Odorants
Aromatic Products Co.
Pollak & Schwartz
Rhodia, Inc.
Sindar Corp.
van Ameringen-Haebler, Inc.

Paint Remover Ingredients
Dow Chemical Co.
Pennsylvania Salt Mfg. Co., Industrial Div.

Phosphate Coatings
Pennsylvania Salt Mfg. Co., Industrial Div.

Preservatives
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Buckman Laboratories, Inc.
California Ink Co., Inc.
Carbide and Carbon Chemical Co.
Dow Chemical Co.
E. I. du Pont de Nemours & Co.
Carbide and Carbon Chemical Co.
Nuodex Products Co.
Shepherd Chemical Co.

Protective Colloids
Borden Co.
Kelco Co.
Shawinigan Resins Corp.

Puffing Agents
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.

Reflective Spheres
Flex-O-Lite Mfg. Co.
Potters Brothers, Inc.

Shingle Stain Oil
Neville Chemical Co.

Stabilizers
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Borden Co.
Dow Chemical Co.
Fallek Products Co.
General Aniline & Film Corp.
Minerals & Chemicals Corp. of America
Pennsylvania Salt Mfg. Co., Industrial Div.

Stearates
Advance Solvents & Chemicals, Div. of Carlisle Chemical Works, Inc.
Mallinckrodt Chemical Works
Nuodex Products Co.
M. W. Parsons-Plymouth, Inc.
Smith Chemical & Color Co.
Whittaker, Clark & Daniels, Inc.
Witco Chemical Corp.

Surface Active Agents
Air Reduction Chemical Co.
American Alcolac Corp.
American Cyanamid Co., Organic Chemical Div.
Antara Chemical Div.
Armour Chemical Div.
Atlantic Refining Co.
Atlas Powder Co.
Carbide & Carbon Chemical Co.
E. F. Drew
E. I. du Pont de Nemours & Co.
Geigy Industrial Chemicals
General Mills, Chemical Div.
Glyco Products
Monsanto Chemical Co.
National Aniline Div., Allied Chemical & Dye Corp.
Nopco Chemical Co.
Pennsylvania Salt Mfg. Co., Industrial Div.
Raybo Chemical Co.
Synthetic Chemicals, Inc.
Troy Chemical Co.
Witco Chemical Co.
Wyandotte Chemical Corp.

Surface Preparation Chemicals
American Chemical Paint

Suspension Agents
Fallek Products Co.
B. F. Goodrich Chemical Co.
Kelco Co.
Minerals & Chemicals Corp. of America

Thickeners & Gelling Agents
Borden Co.
Carbide & Carbon Chemical Co.
Dow Chemical Co.
General Aniline & Film Corp.
B. F. Goodrich Chemical Co.
Kelco Co.
Minerals & Chemicals Corp. of America
Price Varnish Co.
Shawinigan Resins Corp.
Shepherd Chemical Co.
Tamms Industries, Inc.
Witco Chemical Corp.
Wyandotte Chemicals Corp.

Vinyl Stabilizers
Harshaw Chemical Co.

Waxes
Advance Solvents & Chemical Div. of Carlisle Chemical Works, Inc.
Bakelite Co.
Carbide & Carbon Chemical Co.
Glyco Products Co.
Semet-Solvay, Petrochemical Div.
Shell Oil Co.
Warwick Wax Co.
Witco Chemical Co.

PRODUCTION EQUIPMENT

Aerosol Charging Unit
Karl Kiefer Machine Co.

Azeotropic Systems
Brighton Copper Works
Blaw-Knox Co., Buflovak Equipment Div.

Ball & Pebble Mills
Paul O. Abbe, Inc.
Abbe Engineering Co.
Baker Perkins
Epworth Mfg. Co.
Patterson Foundry & Machine Co.
Stevenson Co.
U. S. Stoneware Co.

Blenders
Patterson-Kelley Co.
Read-Standard Corp.
Charles Ross & Son Co.

Cleaning Machines
Karl Kiefer Machine Co.

Colloid Mills
Manton-Gaulin Mfg. Co.
Morehouse-Cowles, Inc.
Tri-Homo Corp.
Troy Engine & Machine Co.

Carbon Dioxide
Liquid Carbonic Corp.

Dissolvers
Baker-Perkins
Hy-R-Speed, Inc.
Morehouse-Cowles, Inc.
Patterson Foundry & Machine Co.
Charles Ross & Son Co.

Dowtherm Kettles
Brighton Copper Works
Blaw-Knox Co., Buflovak Equipment Div.

Drum Mixers
U. S. Stoneware Co.

Filling Machines
C. M. Ambrose Co.
Bowser, Inc.
Hope Machine Co.
Karl Kiefer Machine Co.

Filters
Cuno Engineering Corp.
Hercules Filter Corp.
Sparkler Mfg. Co.

Filtering Aids
Great Lakes Carbon Corp., Dicalite Div.
Johns-Manville

Filter Press
Biach Industries, Inc.
Sparkler Mfg. Co.

Gaskets
U. S. Stoneware Co.

Grinding Media
Pau. O. Abbe, Inc.
Abbe Engineering Co.
LZP Industrial Ceramics Co.
McDanel Refractory Porcelain Co.
Patterson Foundry & Machine Co.
Stevenson Co.
U. S. Stoneware Co.

Inert Gas Generators
C. M. Kemp Mfg. Co.

Labelling Machines
Chisholm-Ryder Co. of Pennsylvania
King Sales & Engineering Co.

Laboratory Mills
U. S. Stoneware Co.

Lid Dropper & Compressor
Karl Kiefer Machine Co.

Liquid Depth Indicators
Petrometer Corp.

Mill Head Assemblies
McDanel Refractory Porcelain Co.

Mill Jars
U. S. Stoneware Co.

Mill Linings
Paul O. Abbe, Inc.
LZP Industrial Ceramics Co.
McDanel Refractory Porcelain Co.
Patterson Foundry & Machine Co.
Stevenson Co.

Mixers & Agitators
Paul O. Abbe, Inc.
Baker Perkins, Inc.
Brighton Copper Works
J. H. Day Co.
Epworth Mfg. Co.
Herman Hockmeyer & Co.
Hy-R-Speed, Inc.
International Engineering Corp.
J. M. Lehmann Co., Inc.
Mixing Equipment Co.
Patterson Foundry & Machine Co.
Read Standard Corp.

Charles Ross & Son Co.
Stevenson Co.
Troy Engine & Machine Co.

Positive Displacement Meter

Bowser, Inc.
Rockwell Mfg. Co.

Pumps

Blackmer Pump Co.
Foster Pump Works, Inc.

Resin & Varnish Kettles

Blaw-Know Co., Buflovak Equipment Div.
Brighton Copper Works
Patterson Foundry & Machine Co.

Rollers For Barrels

Paul O. Abbe, Inc.

Roller Mills

Chemical & Pharmaceutical Industry Co., Inc.
J. H. Day Co.
J. M. Lehmann Co., Inc.
Kent Machine Works, Inc.
Charles Ross & Son Co.
Troy Engine & Machine Co.

Sieving & Screening Machines

J. M. Lehmann Co., Inc.

Specific Gravity Indicator

Petrometer Corp.

Stone Mills

Hy-R-Speed, Inc.

Strainers

C. M. Ambrose Co.
Cuno Engineering Corp.

Thinning & Tinting Tank

Stevenson Co.

Tumblers

Paul O. Abbe, Inc.

Material Handling

Barksdale Company
Carrier Conveyor Corporation
Clark Equipment Company
Thomas A. Edison, Inc.
The Elwell-Parker Electric Company
Filpaco Industries
Fuller Company
Hyster Company
The Lunkenheimer
Market Forge Company
The Mercury Mfg. Company
Mitchell Industrial Tire Co., Inc.
Morse Mfg. Co., Inc.
Neptune Meter Company
Nutting Truck & Caster Co., Inc.
The Rapids-Standard Co., Inc.
The Raymond Corporation
Read Standard Corporation
Revolvator Company
Southwest Mill Industrial Equipment Company
Star Welding & Mfg. Division
Stephens-Adamson Mfg. Company
Stewart-Warner Corporation
Towmotor Corporation
Whiting Corporation
Wilder Mfg. Co., Inc.

Testing Equipment

Atlas Electric Devices
Beckman Instruments
Burrell Corp.
Fisher Scientific Co.
Gardner Laboratories, Inc.
Harshaw Scientific Div.
Hellige, Inc.
Photovolt Corp.
Precision Scientific Co.

Containers, Pails and Cans

Aluminum Co. of America
American Can Co.
Bennett Industries, Inc.
Continental Can Co., Inc.
Crown Cork & Seal Co., Inc., Can Div.
The Davies Can Co.
Fein's Tin Can Co., Inc.
Geuder-Paeschke & Frey Co.
Inland Steel Container Co.
Jones & Laughlin Steel Corp.
National Can Corp.
National Steel Container Corp.
Pressed Steel Tank Co.
Rheem Mfg. Co.
Stern Can Co.
United States Steel Products Div.
Vulcan Container, Inc.
Vulcan Steel Container, Inc.

Color Cards

Colwell Press, Inc.
General Printing Corp.
Gorr Color Card, Inc.
Matherson-Selig
Strobridge Color Card
White Color Card

TRADE NAME INDEX OF RAW MATERIALS AND EQUIPMENT

A

AA—Refined castor Oil. **Baker Castor Oil Co.**
Abay—Mill & Mixing Machinery. **Paul O. Abbe Inc.**
Abbe—Mills & mixing machinery. **Paul O. Abbe Inc.**
Abbe—Mills & mixing machinery. **Abbe Engeneering Company.**
Abitol—Technical hydroabietyl alcohol. **Hercules Powder Company**
AC—Polyethylene. **Semet-Solvay Petrochemical Division**
Accu-Por—Round nozzle top paint cans. **American Can Co.**
Acetate P.A.—Deodorant. **Givaudan-Delawanna, Inc.**
Acetex—Emulsion copolymer. **Naugatuck Chemical Div., U. S. Rubber Co.**
Acintene—Pinenes and turpentine. **Arizona Chemical Company**
Acintol—Tall Oil. **Arizona Chemical Company**
Acme—Shellac Varnish. **Acme Shellac Products Co.**
Aconew Extra—Refined tall oil fatty acids. **Newport Industries, Inc.**
Aconon—Refined tall oil. **Newport Industries, Inc.**
Acosix—Refined tall oil. **Newport Industries, Inc.**
Acrawax C—Synthetic wax. **Glyco Products Co., Inc.**
Acryloid—Acrylic ester resins. **Rohm & Haas Company**
Acrylon—Acrylic rubber. **The Borden Company**
Acrylonitrile—Monomers. **Carbide and Carbon Chemicals Company**
Acrysol—Acrylic resin. **Rohm & Haas Company**
Activ-8—Drier-stabilizer. **R. T. Vanderbilt Co.**
Adher-O-Flex—Esterified Shellac. **Acme Shellac Products Co.**
Adipol—Plasticizer. **Ohio-Apex Division**
Adlube—Plastic mold lubricant. **Advance Solvents & Chemical Corp.**
ADM Adols—Fatty Alcohols. **Archer Daniels Midland Company**
ADM Ester Gum—Complete line of Ester Gums. **Archer Daniels Midland Company**
ADM Natural Resins—Congo, Damar, East India, Kauri Gum, Manila Gum. **Archer Daniels Midland Company**
ADM Processed Congo—Fused & Esterified Congo Gum. **Archer Daniels Midland Company**
ADM Unadols—Fatty Alochols. **Archer Daniels Midland Company**
Adol—Fatty Alcohols. **Archer Daniels Midland Company**
A D P—Carbon Black dispersions. **Acheson Dispersed Pigments Co.**
Advacide—Fungicidal compound. **Advance Solvents & Chemical Corp.**
Advagum—Synthetic rubber extender. **Advance Solvents & Chemical Corp.**
Advamin—Fungicidal compound. **Advance Solvents & Chemical Corp.**
Advamix—Wetting agent. **Advance Solvents & Chemical Corporation**
Advan—Accelerators. **Advance Solvents & Chemical Corp.**
Advance—Naphthenate paint dryers. **Advance Solvents & Chemical Corp.**
Advaresin—Drying oil extenders. **Advance Solvents & Chemical Corp.**
Advasol—Driers. **Advance Solvents & Chemical Corp.**
Advastab—Vinyl resin stabilizers. **Advance Solvents & Chemical Corp.**
Advawax—Petroleum waxes. **Advance Solvents & Chemical Corp.**
Advawet—Wetting agents. **Advance Solvents & Chemical Corp.**
Aero—Maleic and Phthalic Anhydrides; various grades of Aluminum, Zinc, and Calcium Metallic Soaps. **American Cyanamid Company**
Aerosol—Surface Active Agents. **American Cyanamid Company**
Air-Maxic—Small parts washer. **The Protectoseal Co.**
Alamac—Fatty amine esters. **General Mills, Inc.**
Alamask—Paint deodorant. **Rhodia, Inc.**
Alamine—Primary fatty amines. **General Mills, Inc.**
Alathon—Polyethylene resin. **E. I. du Pont de Nemours & Co.**
Albacar—Precipitated calcium carbonate. **C. K. Williams & Co.**
Albalith—Lithopone. **New Jersey Zinc Co.**
Albone—Hydrogen peroxide. **E. I. du Pont de Nemours & Co.**
Albron—Aluminum Powders and Pastes. **Aluminum Company of America**
Alcoa—Aluminum Powders and Pastes. **Aluminum Company of America**
Alcolec—Lecithin. **American Lecithin Co., Inc.**
Algel—Gelling agent. **Raybo Chemical Co.**
Aliphat—Tall oil fatty acids. **General Mills, Inc.**
Alkaterges—Surface active agents. **Commercial Solvents Corporation**
Alkyum—Alkyd Resin. **Adco Chemical Co.**
Alodine—Protective coating chemicals for aluminum and aluminum alloys. **American Chemical Paint Company**
Alrosols—Surface Active agent. **Geigy Industrial Chemicals**
Alsibronz—Water ground mica. **Franklin Mineral Products Company**
Amberlac—Modified alkyds. **Rohm & Haas Co.**
Amberol—Varnish and lacquer resins. **Rohm & Haas Company**
Ambrose—Filling and sealing machines and strainers. **C. M. Ambrose Co.**
Amine O—Surface active agent. **Geigy Industrial Chemicals**
Amsco-Solv—A group of intermediate aromatic petroleum solvents in varying boiling ranges. **American Mineral Spirits Company**
Amyl Acetate—Synthetic solvent. **Industrial Div., Pennsalt**
Analyte—Color comparator. **Crown Engineering & Sales Company**
Angular—Mixer. **Troy Engine & Machine Co.**
Ansol—Solvents. **U. S. Industrial Chemicals Co.**
Antifoam A—Silicone defoamer. **Dow Corning Corp.**
Antioxidant B—Anti-skinning agent and antioxidant. **National Aniline Division**
Antioxidant D—Antiskinning agent and antioxidant. **National Aniline Division**
AntiSag—Anti-sagging, anti-settling, wetting and dispersing agent. **Raybo Chemical Company**
AntiSilk—Anti-silking, anti-floating agent. **Raybo Chemical Company**
Antiskin—Anti-skinning agent. **Raybo Chemical Company**
Antistat—Anti-static agent. **Raybo Chemical Company**
Apco—Aliphatic hydrocarbon thinner. **Anderson-Prichard Oil Corporation**
Apcothinner—Aliphatic petroleum thinner. **Anderson-Prichard Oil Corporation**
Aquablak—Carbon and bone blacks. **Columbian Carbon Co.**
Aquasperse 30—Casein vehicle for emulsion paints. **American Resinous Chemicals Corp.**
AR—Polyester resins. **General Electric**
Araldite—Epoxy resins. **Ciba Company Inc.**
A-Resin—Heat convertible unsaturated aliphatic pure hydrogen polymer. **Enjay Company, Inc.**
Aritemp—Epoxy Casting Resins. **Aries Laboratories, Inc.**
Aricite—Grinding balls. **Patterson Foundry & Machine Co.**
Armac—Acetic acid salts of fatty amines. **Armour Chemical Division**
Armeens—High molecular weight aliphatic amines. **Armour Chemical Division**
Armids—Aliphatic amides. **Armour Chemical Div.**
Arochem—Modified Phenolic Resins, modified maleic resins, specialty resins. **Archer Daniels Midland Company**
Aroclor—Chlorinated biphenyl resins. **Monsanto Chemical Company**
Arofene—Pure Phenolic Resins. **Archer Daniels Midland Company**
Aroflat—Alkyds & Specialties for Flat Finishes. **Archer Daniels Midland Company**
Aroflo—Channel black. **J. M. Huber Corp.**
Aroostocrat—Potato Starch. **Morningstar, Nicol, Inc.**
Aroplaz—Alkyd and Allied Resins. **Archer Daniels Midland Company**
Aropol—Copolymer Modified Alkyds, Polyester Resins. **Archer Daniels Midland Company**
Arquads—Quaternary ammonium salts. **Armour Chemical Div.**
Arrow Ink Black—Channel Black. **J. M. Huber Corp.**
ASA—Antiskinning agent and antioxidant. **National Aniline Division**
Asbestol—Calcium carbonate extender pigments. **Carbola Chemical Company**
ASP—Extender pigments, aluminum silicate **Minerals & Chemicals Corp. of America**
ASRA—Three-roller ointment mills. **Chemica and Pharmeceutical Industry Co., Inc.**
Atlac—Polyester Alkyd Resins. **Atlas Powder Company**
Atlas—Dry colors. **H. Kohnstamm & Co., Inc.**
Attaclay—Finely powdered fullers earth. **Minerals & Chemicals Corp. of America**
Attasol—Colloidal fullers earth. **Minerals & Chemicals Corp. of America**
Attasorb—Fullers Earth. **Minerals & Chemicals Corp. of America**
Aulabrite—Water dilutable color emulsions. **Aula Chemicals, Inc.**
Auto-Klean—All metal edge type filter. **The Cuno Engineering Corp.**
Azo—Zinc Oxide pigments; lead-free and leaded. **American Zinc Sales Company**

B

Bahama Blue—Phthalocyanine blue pulps. **Standard Ultramarine & Color Co.**
Bakelite—Vinyl, polyethylene, phenolic and epoxy resins, emulsions and solutions. **Bakelite Co.**
Barber Gilsonite—Hydrocarbon resin. **American Gilsonite Co.**
Barden—Kaolin. **J. M. Huber Corp.**
Baryta White—99% Ba SO_4 white barytes. **DeLore Div., National Lead Co.**
BCU—Urea resins. **Bakelite Company**
Bear—Lampblack. **Monsanto Chemical Co.**
Beckacite—Modified Phenolic resins. **Reichhold Chemicals, Inc.**
Beckamine—Urea-formaldehyde resins. **Reichhold Chemicals, Inc.**
Beckopol—Modified phenolic resins. **Reichhold Chemicals, Inc.**
Beckolin—Synthetic drying oils. **Reichhold Chemicals, Inc.**
Beckosol—Pure and modified alkyd resins. **Reichhold Chemicals, Inc.**
Beetle—Urea-Formaldehyde Resins. **American Cyanamid Company**
Benthal—Polyhydric alcohol. **Monsanto Chemical Company**
Bentone—Gelling Agents. **National Lead Co.**
Benzoflex—Chemical Plasticizers. **Tennessee Products & Chemical Corporation**
Benzo Sol—Light Naphtha. **Shell Oil Company**
Big-M-Gel—Long oil liquid gel. **Adco Chemical Company**
BKS—Polystyrene emulsion. **The Bakelite Co.**
Black Pearls—Carbon Black pigments. **Godfrey L. Cabot, Inc.**
Black Shield—Pigment dispersions. **Carbon Dispersions, Inc.**
Blancol—Anionic dispersant. **Antara Chemicals**
B. M. G.—Long oil liquid gel. **Adco Chemical Compnay**
Borotherm—Highly soluble borate composition for fire resistant water-base paints. **American Potash & Chemical Corp.**
Boxeal—Case sealing glue. **Paisley Products, Inc.**
BRC—Resinous hydrocarbon plasticizer. **Barrett Division**
BR Castor Oil—Bleached, refined, raw castor oil. **Pacific Vegetable Oil Corp.**
Brij—Emulsifiers; polyoxyethylene lauryl ethers. **Atlas Powder Company**
Bronoco—Aliphatic and aromatic petroleum solvents. **The R. J. Brown Company**
BRS—Polyester resins. **Bakelite Company**
Buckeye Pro-Cote—Protein thickener-stabilizer. **The Buckeye Cotton Oil Company**
Buckeye Protein—Protein thickener-stabilizer. **The Buckeye Cotton Oil Company**
Bufen 30—Preservative. **Buckman Laboratories, Inc.**
Bufenoleate 30—Preservative. **Buckman Laboratories, Inc.**
Bulls Eye Brand—Shellac gums. **William Zinsser & Co., Inc.**
Burnok—Thixotropic paint vehicles. **Fred'k. A. Stresen-Reuter, Inc.**
Burnok—Thixotropic vehicles. **T. F. Washburn Company**
Burtonite—Guar Seed Gum. **The Burtonite Co.**
Burundum—Grinding media. **The U. S. Stoneware Company**
Butaprene—Paint latex. **The Firestone Plastics Company**
Butarez—Petroleum hydrocarbon resin. **Phillips Petroleum Company**
Butrol—Preservative. **Buckman Laboratories, Inc.**
Butvar—Polyvinyl butyral resin. **Shawinigan Resins Corporation**

C

Cabarose Red—B.O.N. maroon. **B. F. Goodrich Chemical Co.**
Cabflex—Chemical plasticizers. **Godfrey L. Cabot, Inc.**
Cab-o-sil—Silica pigments used in paints and varnishes. **Godfrey L. Cabot, Inc.**
Cabotite—Nonmetallic mineral extender pigment. **Godfrey L. Cabot, Inc.**
Caddy Red Toner R-6222—Pyrazolone reds. **B. F. Goodrich Chemical Co.**
Cadmolith—Cadmium red and yellow lithipones. **The Glidden Company.**
Calcicoater Oil—Bodies Vegetable oil. **Pacific Vegetable Oil Corp.**
Calex—Emulsion Vehicle. **California Ink. Co., Inc.**
Calinate—Calcium soaps. **The Harshaw Chemical Company**
Calkyd—Alkyd Vehicle. **California Ink Co., Inc.**
Calo—Dipentene, pine oil, pitch. **John H. Calo Co.**
Caltrol—Viscosity controller. **Brown-Allen Chemicals, Inc.**
Carbitol—Solvent. **Carbide and Carbon Chemicals Company**
Carbo Blue—Iron blue dispersions. **Kentucky Color & Chemical Company**
Carbolac—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Carbopol—Water sensitive gum, paint thickener **B. F. Goodrich Chemical Company**
Carbose—Sodium Carboxymethylcellulose. **Wyandotte Chemicals Corp.**
Cargillon—Polyester resins. **Cargill, Inc.**
Cargoils—Fish oil based oils for barn paints. **Cargill, Inc.**
Cascoloids—Latex Stabilizers. **The Borden Company**
Castorwax—Waxlike, hydrogenated castor oil. **Baker Castor Oil Co.**
Castung—Dehydrated castor oil. **Baker Castor Oil Co.**
C-D-M—Centrifugally Cast Dual Metal Rolls. **J. M. Lehmann Co., Inc.**
Celanese CL—Polyvinyl acetate emulsions. **Celanese Corporation of America.**
Celanese Solvent—Solvent. **Celanese Corporation of America.**
Celite—Extender pigment, diatomaceous silica. **Johns-Manville Products Corp.**
Cellolyn—Abitol-derived alkyds and modified pentaerythritol esters of rosin. **Hercules Powder Company**
Cellosize—Hydroxyethyl Cellulose. **Carbide and Carbon Chemicals Division**
Cellosolve—Solvent. **Carbide and Carbon Chemicals Company**
Century Red, Orange, Blue—Indanthrone colors. **Kentucky Color & Chemical Company**
Cerulean Blue—Cobalt pigment. **Harshaw Chemical Co.**
Charlotte—Colloid Mill. **Chemicolloid Laboratories Inc.**
Chembine—Ester of polyalcohol. **Naftone, Inc.**
Chempol—Resins. **Freeman Chemical Corp.**
Chemstor—Glass lined storage tanks. **The Pfaudler Company**
Cherokee—Kaolin Clay. **R. T. Vanderbilt Co.**
Chlorowax 40—Plasticizer; liquid chlorinated paraffin. **Diamond Alkali Company**
Chlorowax 70—Resinous chlorinated paraffin. **Diamond Alkali Company**
Cicoil—Oiticica oil—**Brazil Oiticica, Inc.**
Cidao—Oiticica and castor oils. **Brazilian Industrial Oils, Inc.**
Citation Red—Permanent red 2-B, BON type. **Kentucky Color & Chemical Company**
Citro Deodorant—Paint deodorant. **Florida Molasses Corporation**
Citroflex—Citric acid ester plasticizers. **Chas. Pfizer & Co., Inc.**
Clearate—Lecithin. **W. A. Cleary Corp.**
CMC—Sodium carboxymethylcellulose. **Hercules Powder Company**
Coacetateblak—Carbon black cellulose acetate chips. **Columbian Carbon Co.**
Coacrylateblak—High color carbon black. **Columbian Carbon Co.**
Cobalt 254—Loss of dry inhibitor. **Nuodex Products Company, Inc.**
Cobalt Blue PX922—Cobalt aluminate. **The Harshaw Chemical Co.**
Coblac—Carbon black nitrocellulose dispersions. **Columbian Carbon Co.**
Codispersion—Carbon black dispersions in various vehicles. **Columbian Carbon Co.**
Coethloblak—Black chip of dispersed carbon black in ethyl cellulose. **Columbian Carbon Co.**
C-Oil—Hydrocarbon drying oil. **Enjay Company, Inc.**
Cold-Pro—Bleached Shellac. **Acme Shellac Products Company**
Coloidex—Surface treated carbon blacks. **Columbian Carbon Co.**
Colortrend—Universal dispersions. **California Ink. Co., Inc.**
Common Sense—Disc filter **Filpaco Industries**
Concord—Wet ground mica. **Concord Mica Corp.**
Concord Maroon—Deep BON Maroon. **Standard Ultramarine & Color Company**
Conoco—Petroleum solvent. **Continental Oil Co.**
Continental—Carbon Blacks. **Witco Chemical Company**
Continental—Kaolin Clay. **R. T. Vanderbilt Company**
Continex—Furnace carbon black. **Witco Chemical Company**
Coors—High density grinding media. **LZP Industrial Ceramics**
Coresin blak—Black pastes. **Columbian Carbon Co.**
Cosden—Solids. **Cosden Petroleum Corp.**
Cosden Polyvis—Polybutene. **Cosden Petroleum Corp.**
Cosol—High-flash naphtha. **Neville Chemical Company**
Covarnish blak—Dry powders. **Columbian Carbon Co.**
Covertex—Vehicles for emulsion paints and latex. **McCloskey Varnish Company**
Covinylblak—Dry chips. **Columbian Carbon Co.**
Cowles—Mixers. **Morehouse-Cowles Inc.**
CP Toluidine Maroon MT-1—Toluidine maroons **B. F. Goodrich Chemical Co.**
CP Toluidine Toner RT-1—Toluidine reds. **B. F. Goodrich Chemical Co.**
CRCO New Way—Labeling and packaging machines. **Chisholm-Ryder Co. of Pennsylvania**
Crypton ZS—Zinc sulfide. **New Jersey Zinc Co.**
Crystal O—Castor oil. **Baker Castor Oil Co.**
CTLA—Heat-reactive, aromatic-type olefinic hydrocarbon polymer. **Enjay Company Inc.**
Cumar—Paracoumarone-indene resins. **Barrett Division**
Cunilate—Fungicides. **Scientific Oil Compounding Company, Inc.**
Cunimene—Fungicides. **Scientific Oil Compounding Company, Inc.**
Cuprous Oxide—Anti-fouling copper pigment. **The Glidden Co.**
Cyanegg—Sodium cyanide. **E. I. du Pont de Nemours & Company, Inc.**
Cyclodex—An emulsifiable cobalt catalyst. **Nuodex Products Company, Inc.**
Cyclo Sol—Aromatic Solvents. **Shell Oil Company**
Cyclowhirl—Portable mixer. **The Kwerel Co.**
Cycolac—Styrene copolymer resin. **Marbon Chemical Division**
Cycopol—Copolymer Resins. **American Cyanamid Company**
Cykel—Dicyclopentadiene treated vegetable oil. **Spencer Kellogg & Sons Inc.**
Cykelin—Dicyclopentadiene treated linseed oil. **Spencer Kellogg & Sons Inc.**
Cykelsoy—Dicyclopentadiene treated soybean oil. **Spencer Kellogg & Sons Inc.**
C-8—Epoxy resins. **Bakelite Company**
C-12—Resin for emulsions. **Farnow, Inc.**

D

Dag—Colloidal graphite dispersions. **Acheson Colloids Company**
Dapon—Diallyl phthalate prepolymer. **Ohio-Apex Division**
Darex Copolymer—Styrene Butadiene Copolymer. **Dewey & Almy Chemical Co.**
Darex D10P—Chemical Plasticizers. **Dewey & Almy Chemical Company**
Darex Everflex—Polyvinyl Acetate emulsion. **Dewey & Almy Chemical Company**
Darsol—Metal cleaner. **Dacar Chemical Products Company**
Darvan—Dispersing Agents. **R. T. Vanderbilt Company**
Davenite—Water ground mica. **Hayden Mica Company**
Day—Mixers and roll mills. **J. H. Day Co.**
Drapex—Epoxy stearate plasticizer. **Argus Chemical Corp.**
Defoamer ED—Anti-Foam Agent. **El Dorado Oil Works**
Dehydol—Nonionic surface active agent. **Fallek Products Company, Inc.**
Dehydrol—Dehydrated Castor Oil. **The Sherwin-Williams Co.**
DEO Oil—Deodorized fish oil. **Pacific Vegetable Oil Corp.**
Deodorized Apco—Deodorized aliphatic hydrocarbon thinner. **Anderson-Prichard Oil Corp.**
Deoxidine—Metal cleaners and rust removers. **American Chemical Paint Company**
Detrex 79—Cleaner & phosphate treatment for steel. **Detrex Corporation**
D.G.—Magnesium Silicate. **Tamms Industries, Inc.**
Diamond K—Oxidized oils. **Spencer Kellogg & Sons Inc.**
Dicalite—Diatomaceous Silica extender pigment. **Great Lakes Carbon Corporation**
Dicom—Dipentene. **Newport Industries, Inc.**
Dinopol—Plasticizer. **Ohio-Apex Division**
Dipentek—Dipentaerythritol technical. **Heyden Chemical Corporation**
Dipentene No. 122—Solvent—51% dipentene with other terpene hydrocarbons. **Hercules Powder Company**
DiscPerser—Mixer. **Herman Hockmeyer & Co.**
Disperse—Aqueous phase dispersant. **Raybo Chemical Company**
Disperso—Wettable Metallic stearates. **Witco Chemical Company**
Dispersol—Insecticide base. **Shell Oil Company**
Dixie Perfecto—Carbon Black. **United Carbon Company, Inc.**
Dixie Reds—Toluidine and Para Substitutes. **Standard Ultramarine & Color Company**
DMT—Dimethyl terephthalate. **Hercules Powder Company**
Doubl—Limed wood rosin. **Newport Industries, Inc.**
Doubletite—Round friction top paint cans. **American Can Co.**
Dow Corning—Silicones. **Dow Corning Chemical Co.**
Dow Latex—Emulsion of either vinyl chloride, vinylidene chloride copolymer, styrene-butadiene copolymer, or polyvinylidene chloride. **The Dow Chemical Company**
Dowicides—Industrial germicide & fungicides. **Dow Chemical Company**
Dresinate—Surface active sodium and potassium salts of rosins and tall oil. **Hercules Powder Company**
Dri-Film—Silicone water-repellents. **General Electric**
Drisoy—Treated soybean oil. **Spencer Kellogg & Sons Inc.**
Duol—Resinated Lithol Rubine pigment. **E. I. du Pont de Nemours & Company**
Duoreens—N-Alkyl Trimethylene diamines. **Armour Chemical Div.**
Duplicane #517—Sugar cane wax. **Warwick Wax Company, Inc.**
Duraplex—Phthalic alkyd resins. **Rohm & Haas Company**
Duratone Reds—Toluidine and Para Substitutes. **Standard Ultramarine & Color Company**
Durez—Phenol-formaldehyde resins. **Durez Plastics & Chemicals, Inc.**
Duroxon—Soft Waxes. **Dura Commodities Corporation**
Dustex Micro-Silica—Soft amorphous silica. **Tamms Industries, Inc.**
Dutch Boy—Pigments—antimony oxide, calcium carbonate, barytes, white lead, red lead, litharge. Linseed oils, chemical plasticizers. **National Lead Company**
Dutrex—Rubber plasticizers, softeners and extenders. **Shell Oil Co.**
Dryolene—Aliphatic petroleum thinner (VM&P). **Anderson-Prichard Oil Corporation**
Dyal—Alkyd resin. **The Sherwin-Williams Co.**
Dylan—Polyethylene. **Koppers Company, Inc.**
Dylex K-34—Styrene butadiene latex. **Koppers Company, Inc.**
Dymal—Maleic resin. **The Sherwin Williams Co.**
Dymerex—Dimerized wood rosin. **Hercules Powder Company**
Dypenite—Modified phenolic resin. **The Sherwin-Williams Co.**
Dyphene—Phenolic resin. **The Sherwin-Williams Co.**
Dyphos—Stabilizers for vinyls. **National Lead Company**

E

Eagle-Picher—Lead and Zinc Pigments. **The Eagle-Picher Company**
Easy Ride—Conveyors. **Filpaco Industries**
EGD—Acrylic Monomer. **American Monomer Corporation**
EHEC—Ethylated hydroxethyl cellulose. **Hercules Powder Company**
Elastex 40-P—Butyl iso decyl phthalate plasticizer. **Barrett Division**
Eldo—Fatty acids. **El Dorado Oil Works**
Electro-Vapor—Dowtherm Kettles. **Blaw-Knox Co.**
Elf—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Elftex—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Elvacet—Polyvinyl acetate emulsion. **E. I. du Pont de Nemours & Company**
Elvadex—Vinyl acetate copolymer. **E. I. du Pont de Nemours & Company**
Elvanol—Polyvinyl alcohol resin. **E. I. du Pont de Nemours & Company**
Emco—Ball mills, pebble mills, unitized agitator drives. **Epworth Manufacturing Co.**
Emcol H-50A—Hydrocarbon Solvent Emulsifier. **The Emulsol Corporation**
Emerox—Dibasic acids. **Emery Industries, Inc.**
Emersol—Fatty acids made by selective solvent separation. **Emery Industries, Inc.**
Emery—Vegetable fatty acids. **Emery Industries, Inc.**
Emfac—Monobasic acids. **Emery Industries, Inc.**
Empol—Polymerized fatty acids. **Emery Industries, Inc.**
Emulphor—Nonionic surfactant. **Antara Chemicals**
Epi-Rez—Pure epichlorohydrin bisphenol resins. **Jones-Dabney Company**
Epi-Tex—Oil modified epichlorohydrin bisphenol resins. **Jones-Dabney Company**
Epi-Var—Oil modified epichlorohydrin bisphenol resins. **Jones-Dabney Company**
Epocast—Epoxy resins. **Furane Plastics, Inc.**
Epolene—Polyethylene waxes. **Eastman Chemical Prods., Inc.**
Epon—Epoxy resins. **Shell Chemical Corp.**
ERCO Brown—Concentrated brown iron oxides. **Reichard-Coulston, Inc.**
Espesol—Aromatic petroleum solvents. **Eastern States Chemical Corp.**
Eskol—Refined linseed oil. **Spencer Kellogg & Sons Inc.**
Esso—Aliphatic petroleum solvents. **Esso Standard Oil Company**

Ester Gum 8D and 8L—Glycerol esters of pale wood rosin. **Hercules Powder Company**
Estynox—Epoxidized fatty ester plasticizers. **Baker Castor Oil Co.**
Ethocel—Ethyl Cellulose resins. **The Dow Chemical Company**
Ethofats—Surface active agents. **Armour Chemical Division**
Ethomeens—Surface active agents. **Armour Chemical Division**
Ethomids—Surface active agents. **Armour Chemical Division**
Euston White Lead—Basic carbonate of lead. **The Glidden Co.**
EVT-50—Styrene butadiene latex. **Cargill, Inc.**

EXBC—Polyvinyl Ethyl ether polymer. **Bakelite Company**
EXBM—Polyvinyl ethyl ether polymer. **Bakelite Company**
Excelsior—Carbon Black pigment. **Columbian Carbon Company**
Exkins—Volatile ant.-oxidant. **Nuodex Products Company, Inc.**
Exon—Vinyl & Styrene Resins. **Firestone Plastics Company**
Extra Fine—Aluminum pastes and powders. **Silberline Mfg. Company, Inc.**

F

FA—Alkyds. **Farnow, Inc.**
FA—Furfuryl alcohol. **The Quaker Oats Co.**
Fade-Ometer—Sunfastness Testing Machine. **Atlas Electric Devices Company**
FAFL—Flat Alkyd Vehicle. **Farnow, Inc.**
Falk Soybean Oils—Soybean oils, (raw, bodied, blown, kettled and specialty). **Cargill ,Inc.**
Falkidine—Hard drying fish oils. **Cargill, Inc.**
Falkolin—Linseed oils, (raw, bodied, blown, kettled and specialty). **Cargill, Inc.**
Falkomast—Fish and soybean oils specially processed for caulking compounds. **Cargill, Inc.**
Falkore—Esterified tall oils. **Cargill, Inc.**
Falkosoy—Maleinized soybean oils. **Cargill, Inc.**
Falkote—Maleic ester gums. **Cargill, Inc.**
Falkovar—Fish oils, (raw, bodied, blown, kettled and specialty). **Cargill, Inc.**
Falkowood—Maleinized linseed oils and fish oils. **Cargill, Inc.**
Falkyd—Oil modified alkyd resins. **Cargill, Inc.**
Fanchon Yellow—Hansa Yellows. **B. F. Goodrich Chemical Co.**
Farac—Tall oil fatty acid. **Farac Oil & Chem. Co.**
Fastolux—Phthalocyanine green or blue toner. **Ansbacher-Siegle Corp.**
Fast Yellow—Yellow pigment. **RBH Dispersions.**
Fatchemco-O—Emulsifier. **Universal Chemicals Corporation**
FCD—Alkyd, phenolic, natural resins. **France, Campbell & Darling, Inc.**
FEGO—Enamel vehicle. **Farnow, Inc.**
Filmex—Solvent. **U. S. Industrial Chemicals Co.**
Fine—Organic dry colors. **Fine Colors Company**
Flexbond 800—Polyvinyl acetate emulsion. **The Colton Chemical Company**
Flexol—Plasticizers. **Carbide and Carbon Chemicals Company**
Flexowax C—Synthetic wax; anti-mar agent for lacquers. **Glyco Products Company, Inc.**
Flexricin—Castor oil—derived plasticizers. **Baker Castor Oil Co.**
Flextal—High rosin, non-crystallizing distilled tall oil. **Farac Oil & Chem. Co.**
Flexwall—Phthalic alkyd flat wall tall oil vehicle. **Farac Oil & Chem. Co.**
FloInducer—Levelling agent. **Raybo Chemical Company**
Florence—French Process Zinc Oxide. **New Jersey Zinc Company**
Flow-Master—Homogenizer. **Marco Company, Inc.**
Fluorethene—Polymonochlorotrifluoroethylene polymer. **Bakelite Company**
Foamex—Liquid defoaming agent. **Glyco Products Company, Inc.**
Fo-Glo—Rosin gloss oil. **Newport Industries, Inc.**
F-O-M—Float-O-Matic control of rolls. **J. M. Lehmann Company, Inc.**
Formcels—Formaldehyde solutions. **Celanese Corporation of America**
Formvar—Polyvinyl formal resin. **Shawinigan Resins Corporation.**
Fosbond—Phosphate coating and rust-proofing compound. **Pennsylvania Salt Manufacturing Company**
Fosfo—Limed wood rosin. **Newport Industries, Inc.**
Foster—Rotary Pumps. **Foster Pump Works, Inc.**
Fotocol—Proprietary Solvent. **Commercial Solvents Corporation**
FR-28—Sodium Borate, fire retardant. **Pacific Coast Borax Company**
Franklin—Pulverizers. **Franklin P. Miller & Son, Inc.**
Futura—Ball and pebble mill. **Patterson Foundry & Machine Co.**

G

Gafite—Polymethyl alphachloroacrylate. **General Aniline & Film Corp.**
Gelva—Polyvinyl acetate resins. **Shawinigan Resins Corporation**
Gelvatol—Polyvinyl acetate emulsions. **Shawinigan Resins Corporation**
Gen-Flo—Styrene butadiene emulsion. **The General Tire & Rubber Company**
Gensol #2, #6—Terpene solvent. **Newport Industries, Inc.**
Geon Latex—Polyvinyl chloride emulsions. **B. F. Goodrich Chemical Company**
Geon Resin—Polyvinyl chloride resins. **B. F. Goodrich Chemical Company**
GGP Aluminum Extra Brilliant—Flake Aluminum Powder. **U. S. Bronze Powder Works, Inc.**
Glaurin—Grinding aid and dispersing agent. **Glyco Products Company, Inc.**
Globlak—Carbon black—nitrocellulose chip. **Columbian Carbon Co.**
Glyptal—Alkyd resins. **Archer-Daniels-Midland Co.**
G.N.S. #5—Pine Oil. **Newport Industries, Inc.**
Go Getter—Electric lift truck. **Revolvator Co.**
Gold Bond "R" Silica—Amorphous Silica. **Tamms Industries, Inc.**
Gold Drops—Gold dispersions for lacquers. **B. F. Goodrich Chemical Co.**
Good-Rite—Salts of polyacrylic acid. **B. F. Goodrich Chemical Co.**
GPF—Containers. **Geuder-Paeschke & Frey Co.**
Grandodraw—Zinc-phosphate coating chemicals for cold-forming. **American Chemical Paint Company**
Granodine—Zinc-phosphate coating chemicals for bonding paint to steel. **American Chemical Paint Company**
Green-Pond—Lightfast yellow pigment. **E. I. du Pont de Nemours & Co., Inc.**
Grellow—Special lead chromate for green. **Kentucky Color & Chemical Company**
Grip-Tight—Labeling Paste. **Paisley Products, Inc.**
Groco—Fatty acids. **A. Gross & Company**
GRP—Shellacs. **Gillespie-Rogers-Pyatt Co. Inc.**
Gulf—Aliphatic petroleum solvents. **Gulf Oil Corporation**
Guyandot Red Toners—Toluidine Substitutes. **Standard Ultramarine & Color Company**

H

Half-second Butyrate—Cellulose acetate butyrate resin. **Eastman Chemical Products, Inc.**
Halowax—Chlorinated naphthalene waxes. **Bakelite Company**
Harflex—Plasticizers. **Harchem Division**
Harshaw-V—Vinyl Stabilizers. **The Harshaw Chemical Company**
HB-20, 40—Alkyl-aryl type plasticizers. **Monsanto Chemical Company**
Heliogen—Phthalocyanine blue and green pigments. **General Dyestuff Corp.**
Helix—Limed wood rosin. **Newport Industries, Inc.**
Hercoflex—Chemical plasticizers. **Hercules Powder Company**
Hercolyn—Hydrogenated methyl ester of rosin. **Hercules Powder Company**
Hetron—Polyester resins. **Hooker Electrochemical Company**
Hexogen—Paint driers. **Advance Solvents & Chemical Corporation**
Hi-Brite—Fluorescent products. **Shannon Luminous Materials Co.**
Hifos—Limed wood rosin. **Newport Industries, Inc.**
HiSolv Solvents—Petroleum Aromatic solvents. **Pennsylvania Industrial Chemical Corp.**
HiWhite—Airfloated Georgia kaolinite. **J. M. Huber Corp.**
Horse Head—Zinc pigments. **New Jersey Zinc Company**
HR Cobalt 254—A cobalt "feeder" drier. **Nuodex Products Company, Inc.**
HTS—Basic Carbonate White lead. **National Lead Company**
Hydrasperse—Aluminum silicate extender pigment. **J. M. Huber Corp.**
Hydratex—Aluminum silicate extender pigment. **J. M. Huber Corp.**
Hydrofol—Glycerides & fatty acids. **Archer-Daniels-Midland Company**
Hydro-Lock—Convers on unit. **Biach Industries, Inc.**
Hydro-Magna—A suspension of magnesium hydroxide. **Merck & Co., Inc.**
Hyfac—Hydrogenated fatty acid. **Emery Industries, Inc.**
Hypalon—Methacrylic ester polymers and chlorosulfonated polyethylene elastomer. **E. I. du Pont de Nemours & Company**
Hydros—Heat-treated wood Rosin. **Newport Industries, Inc.**
Hy-R-Speed—Mills. **Hy-R-Speed Inc.**
Hy-Speed—Agitators & Mixers. **Alsop Engineering Corporation**

I

I Style—Oblong paint can with screw neck or Neuman opening. **American Can Co.**
IAF Compound—Anti-floating agent. **Imperial Paper & Color Corp.**
Iceberg—Aluminum Silicate Pigments. **Burgess Pigment Company**
Igepal—Emulsifiers. **Antara Chemicals**
Igepon—Wetting & dispersing agents. **Antara Chemicals**
Imperial Colors—Pigments. **Imperial Paper & Color Corp.**
Imperse—Pigment dispersion. **Imperial Paper & Color Corp.**
Impervite—Centrifugal pumps. **Falls Industries, Inc.**
Indo Blue B-1—Indanthrene blues. **B. F. Goodrich Chemical Co.**
Indo Maroon MV-6601—Thio Indigoid maroon. **B. F. Goodrich Chemical Co.**
Indopol—Liquid polybutenes. **Indoil Chemical Company**
Indulin-70-GR-S—Coprecipitate of lignin and a butadiene-styrene copolymer. **West Virginia Pulp and Paper Company**
Indusoil—Distilled tall oil. **West Virginia Pulp & Paper Company**
International—Mixers. **International Engineering, Inc.**
Iosol—Spirit soluble dyes. **National Aniline Division**
Iridite—Chromate conversion coatings. **Allied Research Products, Inc.**
Iron Red—Calcined synthetic yellow oxide. **Reichard-Coulston, Inc.**
Iron Yellow—Precipitated pure yellow oxide. **Reichard-Coulston, Inc.**
Irox—Iron oxides. **Reichard-Coulston, Inc.**
Irrathene—Irradiated polyethylene. **General Electric**
Isco Amorphous Silica—Extender pigment, Silica. **Innis, Speiden & Company, Inc.**
Isofoam—Polyisocyanate foaming resin. **Isocyanate Products, Inc.**
Ivo—Bone blacks. **Columbian Carbon Co.**

J

Jaysol—Isopropyl alcohol. **Enjay Company, Inc.**
Jet—Mixers. **Hermas Machinery Co., Inc.**
Jet Mill—High speed dispersion mill for liquids. **Patterson Foundry & Machine Company**

K

Kadox—Finest particle size Zinc Oxides. **New Jersey Zinc Co.**
Kady Mills—Dispersion Milling Equipment. **Kinetic Dispersion Corporation**
Kaolinites—Hydrated aluminum silicates. **Georgia-Kaolin Co.**
Kapsol—Plasticizer. **Ohio-Apex Division**
Kaymol—Surface active agent, emulsifier, antifoaming agent. **Kraft Chemical Company**
KCC—Talc type extender. **Kraft Chemical Co.**
Kelcosol—Fibrous refined, high viscosity sodium alginate. **Kelco Co.**
Kel-F—Trifluorochloroethylene polymer. **The M. W. Kellogg Company**
Kellin—Refined linseed oil. **Spencer Kellogg & Sons Inc.**
Kel-sol—Universal tinting vehicle. **Spencer Kellogg & Sons Inc.**
Keltex—Granular high viscosity sodium alginate. **Kelco Co.**
Keltrol—Styrenated linseed and soybean oils. **Spencer Kellogg & Sons Inc.**
Kel-Vi-Tol—Linseed varnish oil. **Spencer Kellogg & Sons Inc.**
Kel-X-L—Treated linseed oil. **Spencer Kellogg & Sons Inc.**
Kenflex A—Polymer of aromatic hydrocarbons. **Kenrich Corp.**
Kenite—Extender pigment; diatomaceous earth. **Innis, Speiden & Co., Inc.**
Kneadermaster—Dispersion type mixer. **Patterson Foundry & Machine Company**
Koflex—Plasticizers and defoamers. **Kolker Chemical Corp.**
Kopol—Congo copal resins. **Reichhold Chemicals, Inc.**
Koresin—Condensation product of p-tertiary butyl phenol with acetylene. **General Dyestuff Corp.**
Korp—Soda-treated wood rosin. **Newport Industries, Inc.**
Kosmolak—Carbon black. **United Carbon Co., Inc.**
Kosmos F-4, BB, 1—Carbon black. **United Carbon Co., Inc.**
KP—Plasticizer. **Ohio-Apex Div.**
KPO—Polymerized linseed oils. **Spencer Kellogg & Sons Inc.**
Kralastic—Styrene-butadiene resins. **Naugatuck Chemical**
Kreelon—Emulsifying wetting and penetrating agent (Anionic). **Wyandotte Chemicals Corp.**
Kromall—Pigment dispersions. **Kromall Chemical & Dispersions Corp.**
Kroma Reds—Pure precipitated red iron oxides. **C. K. Williams & Co.**
Kronisol—Chemical plasticizers. **Ohio-Apex Div.**
Kronitex—Chemical plasticizers. **Ohio-Apex Div.**
Krumbhaar—Phenolic resins. **Krumbhaar Chemicals Inc.**
KTPL—Low molecular weight polystyrene resins. **Koppers Company, Inc.**
K.V.O.—Linseed varnish oils. **Spencer Kellogg & Sons Inc.**

L

Lactol Spirits—An aliphatic naphtha in the toluol evaporation range. **American Mineral Spirits Company**
Laminac—Unsaturated polyester resins. **American Cyanamid Company**
Landora—Soda-treated wood rosin. **Newport Industries, Inc.**

Lauxein—Casein and soybean adhesives. **Monsanto Chemical Co.**
Lauxite—Urea, phenolic, melamine, and resorcinol resins. **Monsanto Chemical Company**
"L" China Clay—China clay. **Tamms Industries, Inc.**
L. C. Lin—Low cost bodied linseed oil. **Brown-Allen Chemicals, Inc.**
Lehigh—Leaded zinc oxide. **New Jersey Zinc Company**
Lemac—Polyvinyl acetate. **The Borden Co.**
Lemol—Polyvinyl alcohol. **The Borden Co.**
Lewisol—Maleic alkyd-modified rosin esters. **Hercules Powder Company**
Lightnin—Mixers. **Mixing Equipment Co., Inc.**
Lignocol—Anti-skinning agent and anti-oxidant. **Heyden Chemical Corporation**
Ligrene—Crude tall oil substitute. **West Virginia Pulp & Paper Co.**
Ligro—Crude tall oil. **West Virginia Pulp & Paper Company**
Lindol—Low color tricresyl phosphate. **Celanese Corporation of America**
Linoresinate—Tall oil type driers. **The Harshaw Chemical Company**
Linstyrol—Styrenated linseed oil. **Spencer Kellogg & Sons Inc.**
Liquiflow—Low pressure bulk CO_2. **Liquid Carbonic Corp.**
Lithoform—Zinc-phosphate coating chemicals for bonding paint to zinc. **American Chemical Paint Company**
Lithol Rubine Toners—Lithol rubines. **B. F. Goodrich Chemical Co.**
Lo-Micron—Barytes. **Whittaker, Clark & Daniels, Inc.**
Lo-Odor—Octasol driers. **The Harshaw Chemical Company**
Lorite—Diatomaceous material. **National Lead Company**
Lorol—Fatty alcohols. **E. I. du Pont de Nemours & Company**
LP-2—Polysulfide hydrocarbon resins. **Thiokol Corporation**
LPR-1—Latex additive. **Naftone, Inc.**
Lucite—Methyl methacrylate resin. **E. I. du Pont de Nemours & Company**
Lumigraphic colors—Special organic colors fluorescing in daylight or under ultraviolet light. **Imperial Paper and Color Corporation**
Luncor PVC—Polyvinyl chloride valves. **Lunkenheimer Company**
Lustrelith—Lithopone. **Chemical Pigment Co.**
Lustrex—Polystyrene resins. **Monsanto Chemical Company**
Lustrex Latex—Polystyrene emulsion. **Monsanto Chemical Company**
Lytron—Interpolymer and styrene latices and resins for surface coatings and latex paints. **Monsanto Chemical Co.**

M

Maglite—Reactive magnesium oxide. **Merck & Co., Inc.**
Magnaflake—Metal Powders and Pastes. **Magna Manufacturing Company, Inc.**
Majestic Yellow—Permanent benzidine yellow. **Imperial Paper & Color Corp.**
Makanol—Unsaturated fatty alcohols. **The Stepan Chemical Company**
Malix 138—Limed wood rosin. **Newport Industries, Inc.**
Mammopol—Modified fish oil. **Pacific Vegetable Oil Corp.**
Mapico—Iron oxide pigments. **Columbian Carbon Company**
Marbon 9200—Styrene copolymer resin & pigment chips. **Marbon Chemical Division**
Marco—Unsaturated polyester resins. **Celanese Corporation of America**
Marcothix—Unsaturated polyester resin. **Celanese Corporation of America**
MarHard—Mar proofing agent. **Raybo Chemical Company**
Marlex—Polyethylene. **Phillips Petroleum Co.**
Marlin Maroon—Yellowish BON maroon. **Standard Ultramarine & Color Company**
Maroc 6—Limed wood rosin. **Newport Industries, Inc.**
Maroon-gold—Transparent durable maroon pigment. **E. I. du Pont de Nemours & Co., Inc.**
Marvinol—Polyvinyl chloride resin. **Naugatuck Chemical**
Maskit #2—Paint deodorant. **Aromatic Products, Incorporated**
M C—Catalyst for unsaturated polyester resins. **Celanese Corporation of America**
M D—Aluminum powders & pastes. **Metals Disintegrating Company Inc.**
M.D.A.—Methylene disalicylic acid. **Heyden Chemical Corporation**
Meadol—Lignin. **The Mead Corporation**
Melmac—Melamine-Formaldehyde resins. **American Cyanamid Company**
Mercadmolith Reds—Cadmium-Mercury colors. **The Glidden Co.**
Mersolite—Fungicides phenyl mercury salts. **Innis, Speiden & Co., Inc.**
Mert ZT—Fungicide. **Carolina Aniline & Extract Company**
Metalead—Metallic lead flakes. **Metalead Products Corporation**
Metasap—Suspending agent. **Nopco Chemical Company**
Methac—Methyl acetate-methanol. **The Borden Company**
Methocel—Methyl cellulose. **The Dow Chemical Company**
Methox—Plasticizer. **Ohio-Apex Div.**
Methyl acetone—Methyl acetate-methanol-acetone. **The Borden Company**
Methylac—Methyl acetate solvent. **The Colton Chemical Company**
Methylon—Chemical-resistant coating intermediates. **General Electric**
Metrolin—Enamel and paint vehicle. **Brown-Allen Chemicals, Inc.**
Metso 99—Surface active agents. **Philadelphia Quartz Company**
Micro-Cel—Synthetic calcium silicates. **Johns-Manville.**
Micro-Klean—Micronic disposable filter cartridge. **The Cuno Engineering Corp.**
Micro-Mica—Finely ground micronized mica. **The English Mica Company**
Micro Stardust—Magnesium silicate. **Tamms Industries, Inc.**
Micro Velva—Calcium carbonate extender pigment. **Carbola Chemical Company**
Midas Gold—Gold pigment. **RBH Dispersions**
Mikro—Milling machinery. **Pulverizing Machinery Company**
Mill—Limed wood rosin. **Newport Industries, Inc.**
Miller—Crushers. **Franklin P. Miller & Sons, Inc.**
Milmer—Fungicides. **Monsanto Chemical Co.**
Ming Orange—Molybdate orange. **Kentucky Color & Chemical Company**
Mintrol Spirits—A new mineral spirits with a very mild odor. **American Mineral Spirits Co.**
Mirasol—Alkyd resins. **C. J. Osborn Company**
Mixall Mixers—Claw mixing propellers. **Craddock Equipment Company, Inc.**
Mix Mor—Mixers. **Hy-R-Speed, Inc.**
Mod col VD—Synthetic thickener for latex paints. **Nopco Chemical Company**
Mogul—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Molacco—Carbon black pigment. **Columbian Carbon Company**
Molora Maroon—Light BON maroon. **Standard Ultramarine & Color Company**
Monamine—Surface active agents. **Mona Industries, Inc.**
Monarch—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Monarch—Copper phthalocyanine blue and green. **Imperial Paper & Color Corp.**
Monachrome Greens—Pigments; co-precipitated phthalocyanine blue and chrome yellow. **Imperial Paper and Color Corporation**
Monastral—Copper phthalocyanine blue and green. **E. I. du Pont de Nemours & Company**
Mondur—Isocyanate. **Mobay Chemical Co.**
Monopentek—Monopentaerythritol. **Heyden Chemical Corporation**
Monoplex—Monomeric ester plasticizers. **Rohm & Haas Company**
Monosulph—Emulsifier for water-based paints. **Nopco Chemical Company**
Montclair Red—Naphthol red toner. **Ansbacher-Siegle Corp.**
Morehouse—Grinding mills. **Morehouse-Cowles Inc.**
Morningstar—Starches and Dextrines. **Morningstar, Nicol, Inc.**
M-P-A—Heat-stable specialty paint additive. **Baker Castor Oil Co.**
MPL Monomer—Autopolymerizable acrylic monomer. **The Borden Company**
M R—Unsaturated polyester resins. **Celanese Corporation of America**
MS2—Alicyclic ketone resin. **Howards & Sons Ltd.**
Multicel—Diatomaceous earth. **Tamms Industries, Inc.**
Multiflex—Calcium carbonate extender pigments. **Diamond Alkali Company**
Multigrip—Steel safety floor plate. **United States Steel Corporation**
Multi-wash—Fume control. **Claude B. Schneible Company**
Multron—Polyester. **Mobay Chemical Co.**
Munn—Soda-treated wood rosin. **Newport Industries, Inc.**
Myverol—High-potency distilled monoesters. **Distillation Products Industries**

N

Naccolene Concentrate—Detergent. **National Aniline Division**
Nacconate—Diisocyanates. **National Aniline Division**
Nacconols—Detergents. **National Aniline Div.**
Naccosol—Wetting agents. **National Aniline Division**
Naccotan—Dispersing agent. **National Aniline Division**
Nadic—Dicarboxylic acid. **National Aniline Division**
Natural-Shape Media—High density grinding media. **LZP Industrial Ceramics**
Naugatex—Copolymer latex. **Naugatuck Chemical Div., U. S. Rubber Co.**
Nebony—Thermoplastic hydrocarbon resins. **Neville Chemical Company**
Neo-fats—Fatty acids. **Armour Chemical Div.**
Neolyn—Rosin derived alkyd resin. **Hercules Powder Company**
Neo Spectra—Carbon black pigment. **Columbian Carbon Company**
Neosol—Ethyl alcohol proprietary solvent. **Shell Chemical Corporation**
Nestaco—Potato starch. **Morningstar, Nicol, Inc.**
Nettco—Agitating equipment. **New England Tank & Tower Company**
Nevillac—Phenol-modified coumarone and alkylated phenols. **Neville Chemical Company**
Nevindene—Coumarone-indene resins. **Neville Chemical Company**
Nevinol—Plasticizing and solvent oils. **Neville Chemical Company**
Nevsolv—Aromatic petroleum solvents. **Neville Chemical Company**
Newport Maroon—Transparent double maroon pigment. **E. I. du Pont de Nemours & Co., Inc.**
Newtrex—Special wood rosin. **Newport Industries, Inc.**
N-Glo-5&5Y—Rosin gloss oil. **Newport Industries, Inc.**
Nildew—Fungicides. **Naftone, Inc.**
Nilskin—Anti-skinning agent. **Naftone, Inc.**
Non-fer-Al—Calcium carbonate extender pigments. **Diamond Alkali Company**
Non-Flocculating Green—Phthalocyanine greens. **B. F. Goodrich Chemical Co.**
Nonic—Surface active agents. **Industrial Div., Pennsalt**
Nonisols—Surface active agent. **Geigy Industrial Chemicals**
Nopco—Anti-foam agents, freeze-thaw stabilizers, wetting agents. **Nopco Chemical Company**
Nopco 1572-R—Polyvinyl acetate emulsion. **Nopco Chemical Company**
Nopcote—Polyamide resins. **Nopco Chemical Company**
Nora—Soda-treated wood rosin. **Newport Industries, Inc.**
Norlin—Catalytically polymerized linseed and soybean oils. **Cargill, Inc.**
Normasol—Stabilizers for vinyls. **National Lead Company**
Norvan—Polyvinyl acetate emulsions. **R. T. Vanderbilt Company**
NPA—Semi-alkyd vehicles. **Farnow, Inc.**
Nuact Paste—Lead "feeder" drier. **Nuodex Products Company, Inc.**
Nuade—Grinding aid. **Nuodex Products Co., Inc.**
Nuba—Coumarone-indene resins. **Neville Chemical Company**
Nulix-15—Limed polymerized wood rosin. **Newport Industries, Inc.**
Nullapon—Sequestering agents. **Antara Chemicals**
Nulskin—Discontinued name for anti-skinning agent. **Raybo Chemical Company**
Nuodex—Fungicides and driers. **Nuodex Products Company, Inc.**
Nuogel A.O.—Thickening agent. **Nuodex Products Company, Inc.**
Nuolates—Tallate driers. **Nuodex Products Company, Inc.**
Nuomix—Surface active agent. **Nuodex Products Company, Inc.**
Nuosept—Non-toxic paint preservative. **Nuodex Products Company, Inc.**
Nuosperse 657—A combination of surface active agents. **Nuodex Products Company, Inc.**
Nuroz—Polymerized wood rosin. **Newport Industries, Inc.**
Nuris—Bodying agents. **Nuodex Products Company, Inc.**
Nyco Super—Phthalocyanine blue and green pigments. **New York Color & Chemical Co.**
Nycolime—Phthalocyanine blue and green pigments. **New York Color & Chemical Co.**
Nytal—Talc. **R. T. Vanderbilt Company**

O

Octasol—Driers. **The Harshaw Chemical Co.**
Ohopex—Plasticizer. **Ohio-Apex Division**
Oitioil—Oiticica oil. **Brazil Oiticica, Inc.**
OKO—Polymerized linseed oils. **Spencer Kellogg & Sons, Inc.**
ONB—Ortho-nitrobiphenyl plasticizer. **Monsanto Chemical Company**
One Point—High speed mills. **Troy Engine & Machine Co.**
Oolitic—Dry milled calcium carbonates. **DeLore Div., National Lead Co.**
OO Silica Smoke—Amorphous Silica. **Tamms Industries, Inc.**
Opalon—Vinyl chloride resin. **Monsanto Chemical Company**
Oronite—Polybutene. **Oronite Chemical Co.**
Orthophen—Amyl phenols for antiskinning. **Industrial Div., Pennsalt**
Orthotone Orange—Ortho-Nitraniline orange. **Standard Ultramarine & Color Company**
Ozlo—Leaded zinc. **The Sherwin-Williams Co**

P

Paco Solvent TR 590—Proprietary alcohol solvent. **Publicker Industries, Inc.**
Paideos—Paint deodorants. **Dodge & Olcott, Inc.**
Paint Base Oil—Special pigmented base oil. **Pacific Vegetable Oil Corp.**
Paintodors—Paint deodorants. **Sindar Corporation**
Paisflex—Polyvinyl acetate resin paint base (internally plasticized). **Paisley Products, Inc.**

Paisley—General line of liquid labeling glues. **Paisley Products, Inc.**
Palconate—Surface active agent. **The Pacific Lumber Company**
Palcotan—Surface active agent. **The Pacific Lumber Company**
Panaflex BN—Hydrocarbon plasticizer. **Pan American Chemicals**
Panapol—Synthetic hydrocarbon drying oils. **Pan American Chemicals**
Panarez—Petroleum hydrocarbon resins. **Pan American Chemicals**
Panasol—High solvency aromatic solvents. **Pan American Chemicals**
Paradene—Coumarone-indene resins. **Neville Chemical Company**
Paragon—Kaolin. **J. M. Huber Corp.**
Paraplex—Plasticizers and polyester resins. **Rohm & Haas Company**
Parapol-S—High molecular weight copolymer of styrene and isobutylene. **Enjay Company, Inc.**
Parasepts—Anti-fungal and anti-bacterial agents. **Heyden Chemical Corporation**
Paricin—Saturated fatty ester plasticizers. **Baker Castor Oil Co.**
Parlon—Chlorinated natural rubber. **Hercules Powder Company**
Pastall—Driers. **The Harshaw Chemical Co.**
Pavoco Oil—Bodied linseed oil. **Pacific Vegetable Oil Corp.**
Pavoil—Bodied oil. **Pacific Vegetable Oil Corp.**
Pavolene—Refined linseed oil. **Pacific Vegetable Oil Corp.**
Pavolin Oil—Bodied linseed oil. **Pacific Vegetable Oil Corp.**
Pavasoy—Bodied soybean oil. **Pacific Vegetable Oil Corp.**
Pavosynth—Modified linseed oil. **Pacific Vegetable Oil Corp.**
Paxwax—Microcrystalline waxes. **National Wax Company**
PC 1244—Defoaming agent. **Monsanto Chemical Company**
PCP Castor Oil—Raw expeller oil, unbleached. **Pacific Vegetable Oil Corp.**
PE—Polyhydric alcohol. **Hercules Powder Co.**
PE-16—Emulsion of chlorinated natural rubber. **Alfred Hague & Company, Inc.**
Peerless—Kaolin clay. **R. T. Vanderbilt Co.**
PEI—Polyethylene imine. **Hansborg & Company**
Penbro—"B" wood resin. **Newport Industries, Inc.**
Penbro 83—Linseed wood rosin. **Newport Industries, Inc.**
Penglo 65—Tall oil penta ester solution. **Newport Industries, Inc.**
Pennco—Pigment dispersions & chips. **Pennsylvania Color & Chemical Company**
Pennsalt—Metal cleaners, alkaline paint strippers, and paint spray booth water conditioners. **Pennsylvania Salt Manufacturing Company**
Penola—Aliphatic and Aromatic Solvents, Naphthas and Varsols. **Penola Oil Company**
Penros—Polymerized wood rosin. **Newport Industries, Inc.**
Pent Acetate—Synthetic amyl acetate. **Industrial Div., Pennsalt**
Pentacite—Pentaerythritol resins. **Reichhold Chemicals, Inc.**
Pentalyn—Pentaerythritol esters of rosin and phenolic-modified pentaerythritol esters of rosin. **Hercules Powder Company**
Pentasol—Synthetic amyl alcohols. **Industrial Div., Pennsalt**
Pentek—Pentaerythritol technical. **Heyden Chemical Corporation**
Perclene—Perchlorethylene. **E. I. du Pont de Nemours & Co., Inc.**
Perlin—Chemically treated linseed oil. **Brown-Allen Chemicals, Inc.**
Permachlor Red—Red dry colors. **Sherwin Williams Company**
Permadine—Zinc phosphate coating chemicals for rust-proofing. **American Chemical Paint Co.**
Permagel—Processed Fullers Earth thickener. **Minerals & Chemicals Corp. of America**
Permaline Blue—Phthalo Lake. **Whittaker, Clark & Daniels, Inc.**
Permanent—Phthalocyanine blue and green pigments. **New York Color & Chemical Co.**
Permansa—Nitroso naphthol green. Chlor-para nitraniline red, and hansa yellow. **The Sherwin-Williams Co.**
Permolith—Lithopone. **The Sherwin-Williams Co.**
Petrex—Unmodified Petrex alkyd resins. **Hercules Powder Co.**
Petro A A—Surface active agent. **Petrochemicals Company**
Petrodor—Paint solvent deodorants. **Dodge & Olcott, Inc.**
Petrohol—Isopropyl alcohol. **Enjay Company, Inc.**
Petrolene—Aliphatic petroleum thinner. **Anderson-Prichard Oil Corporation**
Petrolite—Emulsifiable waxes. **Petrolite Corporation, Ltd.**
Petronauba—Emulsifiable petroleum wax. **Bareco Oil Company**
Petropon—Heavy petroleum polymers. **American Mineral Spirits Company**
Petro-Resins—Polymerized olefinic hydrocarbons. **Petroleum Specialties Company**
Petrosul—Petroleum sulfonate. **Pennsylvania Refining Company**
Petrothene—Polyethylene resins. **U. S. Industrial Chemicals Co.**
Phillips 66—Hydrocarbon solvents. **Phillips Petroleum Company**
Phthalo—Phthalocyanine blue and green pigments. **New York Color & Chemical Co.**
Picco—Solvents & Solvent oils. **Pennsylvania Industrial Chemical Corporation**
Piccolastic—Low molecular wt. polystyrene resins. **Pennsylvania Industrial Chemical Corp.**
Piccolyte—Polyterpene resins. **Pennsylvania Industrial Chemical Corporation**
Piccopale—Petroleum hydrocarbon resin. **Pennsylvania Industrial Chemical Corporation**
Piccopale Emulsion—Petroleum hydrocarbon resin emulsion. **Pennsylvania Industrial Chemical Corporation**
Piccoumaron—Coumarone-Indene resins. **Pennsylvania Industrial Chemical Corporation**
Piper Red—Pyrazalone red. **Ansbacher-Siegle Corp.**
P-K—Twin shell blender. **The Patterson-Kelly Company, Inc.**
Placco-Tex-Latex emulsion. **Pioneer Latex & Chemical Co.**
Planisol—Surface active agent. **The Girdler Company**
Plaskon—Alkyd molding compounds. **Barrett Division**
Plasti-Kote—Aerosol paints. **Plastic-Kote, Inc.**
Plasto—Dyes for plastics. **National Aniline Div.**
Plastoflex—plasticizers. **Advance Solvents & Chemical Corporation**
Plastolein—Chemical & resinous plasticizers. **Emery Industries, Inc.**
Pliolite latex—Styrene-butadiene emulsions. **The Goodyear Tire & Rubber Co. Inc.**
Pliolite, natural rubber—Cyclized natural rubber. **The Goodyear Tire & Rubber Co. Inc.**
Pliolite S-5—Styrene-butadiene resins. **The Goodyear Tire & Rubber Co. Inc.**
Pliovic—Polyvinyl chloride resins. **The Goodyear Tire & Rubber Co. Inc.**
Plumb-O-Sil—Stabilizers for vinyls. **National Lead Company**
Pluronics—Emulsifying agent (nonionic). **Wyandotte Chemicals Corp.**
Plymouth—Stearates. **M. W. Parsons-Plymouth Inc.**
Plyophen—Phenolic resins. **Reichhold Chemicals, Inc.**
PMAC—High boiling solvent-polymethoxy acetal. **General Aniline & Film Corporation**
PMN-10—Fungicide. **Nuodex Products Co., Inc.**
PMO 10—Fungicide. **Nuodex Products Co., Inc.**
POE—Modified polyester enamel vehicle. **Farnow, Inc.**
Polycin—Gelled castor oil. **Baker Castor Oil Co.**
Polyco—Resin emulsions. **The Borden Company**
Polyfon—Surface active agents. **West Virginia Pulp and Paper Company**
Polylite—Polyester Resins. **Reichhold Chemicals, Inc.**
Polymekon—Specially processed petroleum wax. **Warwick Wax Company, Inc.**
Polymer C-3—Modified vinyl acetate resin. **Monsanto Chemical Co.**
Poly-pale Ester—Glycerol ester of polymerized rosin. **Hercules Powder Company**
Poly-Sperse—Plasticizer. **National Polychemicals, Inc.**
Poly-Tex—Polyvinyl acetate copolymer emulsion. **Jones-Dabney Company**
Polywood Oil—Heat treated wood oil. **Brown-Allen Chemicals, Inc.**
Porox—Grinding balls. **Patterson Foundry & Machine Company**
Potters—Reflective spheres. **Potters Brothers, Inc.**
Preventol—Fungicides. **Antara Chemicals**
Prgmol—Latex emulsion leveling agent. **Fred'k. A. Stresen-Reuter, Inc.**
Propocel—Cellulose derivative. **The Dow Chemical Company**
Protatek 53—Sodium alginate thickener. **Croda Incorporated**
Protectoseal—Equipment for protection against fires through the use of flammable liquids. **Protectoseal Company**
Protovacs—Cascinates. **The Borden Company**
PT—Pine tar, pine tar oil, pine oil, destructively distilled wood turpentine. **Godfrey L. Cabot, Inc.**
Puratized OL-28—Phenylmercury oleate. **Gallowhur Chemical Corporation**
Purecal—Ppt. calcium carbonate. **Wyandotte Chemicals Corp.**
Putrol—Deodorant. **Fritzsche Brothers, Inc.**
PVC 100—Polyvinyl chloride. **The Dow Chemical Company**
PVM—Polyvinyl methyl ether. **General Aniline & Film Corp.**
PVM/MA—Methyl vinyl ether-ethyl anhydride copolymers. **General Aniline & Film Corp.**
PVP—Polyvinylpyrrolidone. **General Aniline & Film Corp.**
PX Plasticizers—Chemical and Resinous Plasticizers. **Pittsburgh Coke & Chemical Co.**
Pycal—Chemical Plasticizers. **Atlas Powder Co.**
Pyrax—Foliated aluminum silicate. **Standard Mineral Corp.**
Pyrotone Reds—Chlorinated para toners. **Standard Ultramarine & Color Company**

Q

QO—Furan chemicals & derivatives. **The Quaker Oats Company**
Quindex—Copper-8 quinolinolate solution. **Nuodex Products Co., Inc.**

R

R-856 Resin—Silicone-alkyd resin. **Dow Corning Corp.**
R-878 Resin—Silicone-alkyd resin. **Dow Corning Corp.**
Radiant Yellow—AAOT benzidine yellow toner. **Ansbacher-Siegle Corp.**
Ramapo—Resinated organic pigments. **E. I. du Pont de Nemours & Company**
R & R—Bodying and surface active agents. **Ross & Rowe, Inc.**
Raven—Carbon black pigment. **Columbian Carbon Company**
R-B-H—Pigment dispersions. **R-B-H Dispersions**
R C Plasticizer E S—Polymeric plasticizer. **Rubber Corporation of America**
RD 910—Stabilizer-thickener. **Minnesota Mining & Manufacturing Company**
Readco—Mixers & materials handling equipment. **Read Standard Corporation**
RECO Brown—Concentrated brown iron oxides. **Reichard-Coulston, Inc.**
Red Diamond—Cylinder gas-CO_2. **Liquid Carbonic Corp.**
Red Giant—Hand lift truck. **Revolvator Co.**
Red Toner (Manganese) R-93—B.O.N. reds. **B. F. Goodrich Chemical Co.**
Resimene—Butylated melamine formaldehyde resins. **Monsanto Chemical Company**
Resimene-U—Butylated urea formaldehyde resins. **Monsanto Chemical Company**
Resinox P97—Phenolic resin. **Monsanto Chemical Company**
Resyn—Polyvinyl acetate emulsions. **National Starch Products Inc.**
Resoflex—Plasticizers. **Cambridge Industries, Inc.**
Revolvator—Materials handling equipment. **Revolvator Company**
Rex Orange—Molybdate orange. **Imperial Paper & Color Corp.**
Reynolds Metals—Aluminum Powder & Paste. **Reynolds Metals Company**
Reynolized—Aluminum paste pigment. **Reynolds Metals Company**
Rezamul—Alkyd Emulsions. **Reichhold Chemicals, Inc.**
Rezyl—Oil & resin-modified alkyd resins. **American Cyanamid Company**
Rheotol—Surface active agent. **R. T. Vanderbilt Company**
Rhoplex—Acrylic resin dispersions. **Rohm & Haas Company**
Rhoplex AC-33—Acrylic emulsion. **Rohm & Haas Company**
Richmond Green Dispersion—Pigment green. **Ansbacher-Siegle Corp.**
Roalox—Grinding mill jars. **The U. S. Stoneware Co.**
Rocker-Roll—Drum mixers. **The U. S. Stoneware Co.**
Rodine—Pickling acid inhibitors. **American Chemical Paint Company**
Roller-Type—Laboratory mills. **The U. S. Stoneware Co.**
Rotator—Drum truck. **Morse Manufacturing Company, Inc.**
Rotocan—Change-can mixers. **Baker Perkins, Inc.**
Royal Spectra—Carbon blacks. **Columbian Carbon Co.**
Rubanox Red—Lithol Rubine. **The Sherwin Williams Co.**
Rubbersol #3—Terpene solvent. **Newport Industries, Inc.**
Rubine Reds—Organic red pigments. **Imperial Paper & Color Corp.**
Rustib—Corrosion inhibitor. **Raybo Chemical Company**
RV—Flatting paste. **RBH Dispersions**

S

Safe-T-Hues—Special non-toxic colorants. **H. Kohnstamm & Company, Inc.**
Safflower 22—Isomerized safflower oil. **Pacific Vegetable Oil Corp.**
Saflex—Polyvinyl butyral. **Monsanto Chemical Company**
St. Joe—Lead-free zinc oxide. **St. Joseph Lead Company**
Santicizer—Chemical plasticizers. **Monsanto Chemical Company**
Santocel—Extender pigment, silica aerogel. **Monsanto Chemical Company**
Santolite—Aryl sulfonamide-formaldehyde resins. **Monsanto Chemical Company**
Sapona Reds—Soapfast reds. **Standard Ultramarine & Color Company**
Saran—Vinylidene Chloride polymers. **The Dow Chemical Company**
Sarkosyls—Emulsifiers and anti-corrosive agents. **Geigy Industrial Chemicals**
Sea Gull Brand—Ultramarine blue. **Reckitt's England**
Sealed-Disc—Paint filters. **Alsop Engineering Corporation**
Sequestrene—Metal complexing agent. **Geigy Industrial Chemicals**
Ser-X—Extender pigment; Sericite (hydrous aluminum silicate). **Innis, Speiden & Co., Inc.**

Shannon-Glow—Black light fluorescent products. **Shannon Luminous Materials Co.**
Shannon Line—Black light lamps. **Shannon Luminous Materials Co.**
Shear-flow—Mixers. **Gabb Special Products**
Shellmax—Micro crystalline waxes. **Shell Oil Company**
Shell Sol—Stoddard solvent. **Shell Oil Company**
Shell wax—Paraffin waxes. **Shell Oil Company**
Ship Pitch—Pitch. **Newport Industries, Inc.**
Sierra Fibrene—Extender pigment; Talc (magnesium silicate). **Innis, Speiden & Co., Inc.**
Sierra Mistron—Extender pigment; Talc (magnesium silicate). **Innis, Speiden & Co., Inc.**
Sight-O-Matic—Paint mills. **J. M. Lehmann Co., Inc.**
Silastic—Silicone rubber. **Dow Corning Corp.**
Silex—Extender pigment; hard silica. **Innis, Speiden & Company, Inc.**
Silvar—Aluminum pastes & powders. **Silberline Mfg. Company, Inc.**
Silver Bond "B" Silica—Crystalline-hard silica. **Tamms Industries, Inc.**
Sinclair—Solvents. **Sinclair Chemicals Inc.**
Skellysolve—Aliphatic hydrocarbon solvents. **Skelly Oil Co.**
Skyline Blue—Phthalocyanine blues. **B. F. Goodrich Chemical Co.**
Smico—Process equipment. **Southwest Mill Industrial Equipment Company**
Smithko—Pigments and extenders. **Smith Chemical & Color Company**
Socal Petrolatum—Waxes. **Standard Oil Co. of California**
Socal Solvent—Aromatic Solvent. **Standard Oil Company of California**
Softex Red—Precipitated pure red oxide. **Reichard-Coulston, Inc.**
Solarite—Hydrocarbon resin. **Solar Compounds Corp.**
Solfast—Lightfast organic red, phthalocyanine blue. **The Sherwin-Williams Co.**
Soligen—Paint driers. **Advance Solvents & Chemical Corporation**
Solinox—Process linseed oil. **Spencer Kellogg & Sons Inc.**
Solox—Solvent. **U. S. Industrial Chemicals Co.**
Solros—Heat-treated wood rosin. **Newport Industries, Inc.**
Soltrol—Odorless paint solvents & thinners. **Phillips Petroleum Company**
Solvenol—Mixed terpene solvent. **Hercules Powder Company**
Solvent #30—Terpene solvent. **Newport Industries, Inc.**
Solvesso—Aromatic petroleum solvents. **Esso Standard Oil Company**
Solvoflex—Gaskets. **The U. S. Stoneware Co.**
S-O-M—Sight-O-Matic control of roll pressures. **J. M. Lehmann Co., Inc.**
Sorbo—70% sorbitol solution. **Atlas Powder Co.**
Sovasol—Aliphatic petroleum solvents. **Socony-Vacuum Oil Company**
Soya Paint Oil—Modified soybean oil. **Pacific Vegetable Oil Corp.**
Soya Solinox—Process soybean oil. **Spencer Kellogg & Sons Inc.**
Soyalin—Specially processed soybean oil. **Brown-Allen Chemicals, Inc.**
Soyates—Soybean driers. **The Harshaw Chemical Company**
Soywood Oil—Co-polymerized combination of refined soybean oil and tung oil. **Pacific Vegetable Oil Corp.**
SP Alizarine Maroon MV-7013—Alizarine maroons. **B. F. Goodrich Chemical Co.**
Span—Emulsifiers; fatty acid esters of sorbitol anhydrides. **Atlas Powder Company**
Spangle—Aluminum paint improver. **Raybo Chemical Company**
Sparkler—Horizontal plate filters. **Sparkler Mfg. Co.**
Sparmite—Very fine barium sulfate. **C. K. Williams & Company**
Sparsol—Vinyl type polymer. **Sparta Industries**
SP Blue Toners BT-8—Tungstated blues and violet. **B. F. Goodrich Chemical Co.**
Spectronic 20—Colorimeter. **Bausch & Lomb Optical Company**
Speedee Mite—"Miniature paint factory in a test tube." **Charles E. Barker Company**
SR—Silicone resins. **General Electric**
Stabelan—Vinyl stabilizers. **Harwick Standard Chemical Company**
Staybelite Ester—Glycerol ester of hydrogenated rosin. **Hercules Powder Company**
Stabilizer D-22—Dibutyl tin dilaurate. **Carbide & Carbon Chemicals Company**
Stamford—Aluminum pastes & powders. **Silberline Mfg. Company, Inc.**
Standard—Zinc dust. **New Jersey Zinc Co.**
Standard Refined Wax—Waxes. **Standard Oil Company of California**
Standard Thinner—Aliphatic thinners. **Standard Oil Company of California**
Standardaire—Blower. **Read Standard Corp.**
Stardust—Magnesium silicate. **Tamms Industries, Inc.**
Statex—Carbon black pigment. **Columbian Carbon Company**
Steelco—Distilled tall oils. **K. A. Steel Chemicals Inc.**
Sterling—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Stern-Tite—Paint cans. **Stern Can Co., Inc.**
Steveco—Mixers, grinding equipment, tanks, fans, blowers. **The Stevenson Company**
Strypp-Away—Liquid paint stripper. **The DuBois Company, Inc.**
Stycast—Polystyrene casting resins. **Emerson** & Cuming, Inc.
Stypol—Polyester resins. **H. H. Robertson Co.**
Styresol—Styrenated alkyd resins. **Reichhold Chemicals, Inc.**
Styretex—Styrenated alkyd resins. **Jones-Dabney Company**
Styron—Polystyrene. **The Dow Chemical Co.**
Sunaptic—Naphthenic acids. **Sun Oil Co.**
Sunoco—Solvents. **Sun Oil Co.**
Sunolith—Lithopone. **The Glidden Company**
Sun Yellow—Nickel-titanium dioxide pigment. **The Harshaw Chemical Co.**
Super Ad-It—Fungicide. **Nuodex Products Company, Inc.**
Super Aetna Crimson red Oxide—Produced from crude Persian Gulf red oxide. **Reichard-Coulston, Inc.**
Superloid—Granular high viscosity ammonium alginate. **Kelco Co.**
Super Spectra—Carbon black pigment. **Columbian Carbon Company**
Super Three—Roller mills. **Kent Machine Works, Inc.**
Superba—Carbon black pigment. **Columbian Carbon Company**
Super-Beckacite—Pure phenolic resins. **Reichhold Chemicals, Inc.**
Super-Beckamine—Melamine-formaldehyde Resins. **Reichhold Chemicals, Inc.**
Super-Beckosol—Isophthalic Acid Alkyd Resins. **Reichhold Chemicals, Inc.**
Super IMperse—Aqueous pigment dispersions. **Imperial Paper & Color Corp.**
Supercarbovar—Carbon black pigments. **Godfrey L. Cabot, Inc.**
Superflo—Linseed grinding oils. **Spencer Kellogg & Sons, Inc.**
Superfyde—Formaldehyde polymer. **Heyden Chemical Corporation**
Superior—Linseed varnish oils. **Spencer Kellogg & Sons, Inc.**
Superior—Soybean varnish oils. **Spencer Kellogg & Sons, Inc.**
Superjet—Lampblack. **C. K. Williams & Co.**
Superlin—Catalyzed refined linseed oil. **Brown-Allen Chemicals, Inc.**
Superoil—Low acid refined linseed oil. **Brown-Allen Chemicals, Inc.**
Super-sol—Odorless naphtha. **Pennsylvania Refining Company**
Supreme—Crushers, pulverizers. **Franklin P. Miller & Son, Inc.**
Suprex—Kaolin. **J. M. Huber Corp.**
Surfex—Calcium carbonate extender pigments. **Diamond Alkali Company**
Surfynol—Surface active agent, dispersant. **Air Reduction Chemical Co.**
Suspenso—Calcium carbonate estender pigments. **Diamond Alkali Company**
Susperse B—Anti-sagging, anti-settling, wetting and dispersing agent. **Raybo Chemical Co.**
Swiveloader—Material handling equipment. **Stephens-Adamson Mfg. Company**
Syloid—Extender pigments; silica. **Davison Chemical Company**
Synco—Phenolic resins. **Snyder Chemical Corp.**
Synco 935-D—Cross-linking vinyl copolymer emulsion. **Snyder Chemical Coporation**
SynPar—Hard, high-melting wax. **H. L. Barnebey**
Syntex—Alkyd resins. **Jones-Dabney Company**
Synthaline Blue—Pure phthalo toner. **Whittaker, Clark & Daniels, Inc.**
Synthe-Copal—Ester gum resins. **Reichhold Chemicals, Inc.**
Synthenol—Dehydrated castor oil. **Spencer Kellogg & Sons, Inc.**
Syn-U-Tex—Butylated urea formaldehyde resins. **Jones-Dabney Company**
Synvarite—100% phenolic resins. **Synvar Corp.**
Synvarol—Butylated urea resins. **Synvar Corp.**

T

T 1215—Polymerized linseed oils. **Spencer Kellogg & Sons, Inc.**
Tallene—Tall oil pitch. **West Virginia Pulp & Paper Co.**
Tartan Colors—Organic lakes and toners. **Magruder Color Co., Inc.**
Tasco—Talc. **Tamms Industries, Inc.**
T.A.T. Bentonite—Colloidal clay. **Tamms Industries, Inc.**
T. C.—Calcium carbonates. **Tamms Industries, Inc.**
Tecquinol—Technical hydroquinone. **Eastman Chemical Products, Inc.**
Tecsol—Proprietary solvent based on ethyl alcohol. **Eastman Chemical Products, Inc.**
Teflon—Tetrafluoroethylene resin. **E. I. du Pont de Nemours & Company**
Teglac—Rosin modified dibasic acid resins. **American Cyanamid Company**
Tenex—Heat-treated wood rosin. **Newport Industries, Inc.**
Tenn-Sil—Fillers. **Tennessee Products & Chemical Corp.**
Tergitol—Nonionic and anionic surface active agents. **Carbide and Carbon Chemical Company**
Tetronic—Nonionic wetting agent and dispersant, **Wyandotte Chemicals Corp.**
Texaphor—Anti-setting agent. **Fallek Products Co.**
Texapon—Stabilizer and suspension agent. **Fallek Products Co.**
Texas—Pigment balcks. **Sid Richardson Carbon Co.**
Textile Spirits—An aliphatic naphtha having an evaporation range similar to benzol. **American Mineral Spirits Company**
T-Glo-8 & 8Y—Tall oil gloss oil. **Newport Industries, Inc.**
Thermatomic Black—Special purpose carbon black. **Thermatomic Carbon Co.**
Thermax, P-33—Carbon blacks. **R. T. Vanderbilt Company**
Thermoil-Granodine—Manganese iron phosphate coating chemicals for wear-proofing and rust-proofing. **American Chemical Paint Company**
Thermolite—Stabilizers for vinyls. **Metal & Thermit Corporation**
THFA—Tetrahydrofurfuryl alcohol. **The Quaker Oats Company**
Thixin—Multi-purpose paint additive. **Baker Castor Oil Co.**
Thoro Blender—Conical dry blender & mixer. **Patterson Foundry & Machine Company**
Ti-Cal—Titanium calcium pigments. **E. I. du Pont de Nemours & Company**
Tipen—Isophthalic tall oil alkyd. **Farac Oil & Chem. Co.**
Tints-All—Universal tinting colors. **Sheffield Bronze Paint Corp.**
Ti-Pure—Titanium dioxide pigments, rutile and anatase. **E. I. du Pont de Nemours & Co.**
Titanolith—Titanated lithopone. **The Glidden Company**
Titanox—Titanium dioxide pigments; rutile, anatase, non-pigmentary, titanium calcium. **Titanium Pigment Corporation**
TK—Flatting paste. **RBH Dispersions**
TME—Trimethylolethane. **Heyden Chemical Corporation**
TMP—Trimethylolpropane. **Heyden Chemical Corporation**
Tolbe—Tall oil pitch. **Newport Industries, Inc.**
Tolusol—Lacquer diluent. **Shell Oil Company**
Toxilic—Maleic acid. **National Aniline Division**
Toximul 250—Emulsifier. **Ninol Laboratories**
Transphalt—Asphaltic hydrocarbon resin. **Pennsylvania Industrial Chemical Corporation**
Transveyor—Compact, low-cost stacker. **Automatic Transportation Company**
Troykyd—Fungicides, puffing & bodying agents, anti-floating agents, anti-sagging agents, anti-settling agents, anti-skinning agents, wetting agents, dispersing agents. **Troy Chemical Co.**
Triangle—Carbon black. **United Carbon Co., Inc.**
Tribase—Stabilizers for vinyls. **National Lead Company**
Triclene—Trichlorethylene. **E. I. du Pont de Nemours & Company, Inc.**
Tri-Homo—Homogenizing machinery. **Tri-Homo Corporation**
Tripentek—Tripentaerythritol technical. **Heyden Chemical Corporation**
Triple Action—High speed colloid mills. **Troy Engine & Machine Co.**
Triton—Surface active agents. **Rohm & Haas Company**
Troluoil—Aliphatic petroleum thinner. **Anderson-Prichard Corporation**
Tween—Emulsifiers; polyoxyethylene sorbitan fatty acid esters. **Atlas Powder Company**
Twitchell—Emulsifying agents. **Emery Industries, Inc.**
Ty-Bond—Zinc phosphate coating for metal. **Cowles Chemical Company**
Typhoon Agitator—Portable liquid mixer. **Patterson Foundry & Machine Company**

U

Ubatol—Modified polystyrene emulsion. **Union Bay State Chemical Co., Inc.**
Uformite—Urea-formaldehyde and melamine-formaldehyde resins. **Rohm & Haas Company**
Ultrapole S—Amine condensate. **Ultra Chemical Works, Inc.**
Ultra-Turrax—Colloid Mills. **Cartrite International, Inc.**
Unapex—Latex paint base. **Naftone, Inc.**
Unimixers—Vertical liquid mixer. **Patterson Foundry & Machine Company**
Unipower—Agitator-mixer drive. **Patterson Foundry & Machine Company**
Unitane—Titanium dioxide pigment. **American Cyanamid Co.**
Unitol—Refined Tall Oil. **Union Bag & Paper Corporation**
Uplifter—Portable elevator. **Revolvator Co.**
U.S.I. Isosebacic Acid—Mixture of isomers of sebacic acid. **U. S. Industrial Chemicals Co.**
USS—Aromatic hydrocarbon solvents. **United States Steel Corporation**
USSCO—Ball mills. **The U. S. Stoneware Co.**
Utilitank—Glass lined storage tanks. **The Pfaudler Company**
Uversol—Driers. **The Harshaw Chemical Company**
Uvinul—Ultraviolet absorbers. **Antara Chemicals**

V

Vac Dry—Bleached shellac gum. **William Zinsser & Co., Inc.**
Vale Green—Chrome green pigment. **Imperial Paper & Color Corp.**

Vancide—Fungicides. **R. T. Vanderbilt Co.**
Vandor—Paint deodorant. **van Ameringen-Haebler, Inc.**
Varayd—Alkyds. **Farnow, Inc.**
Varez—Resin solutions. **McCloskey Varnish Co.**
Vari-Visco—Filling machine. **The Karl Kiefer Machine Co.**
Varkydols—Special drying oils. **McCloskey Varnish Company**
Varkyds—Alkyds, phthalic, non-phthalic and modified. **McCloskey Varnish Comapny**
Veegum—Magnesium aluminum silicate. **R. T. Vanderbilt Company**
Velsicol—Hydrocarbon resins and aromatic hydrocarbon solvents. **Velsicol Corporation**
Velvet Green—Chrome green pigment. **Imperial Paper & Color Corp.**
Velveteen "R" Silica—Amorphous silica. **Tamms Industries, Inc.**
Venus Natural Copper—Flake Copper Powder. **U. S. Bronze Powder Works, Inc.**
Venus Palegold—Gold bronze powder. **U. S. Bronze Powder Works, Inc.**
Vera Blanc—Water ground calcium carbonate. **DeLore Div., National Lead Co.**
Versamides—Polyamide resins. **General Mills, Inc.**
Vibrin—Polyester resins. **Naugatuck Chemical**
Vi-Cron—Very fine ground limestone. **C. K. Williams & Company**
Vinac—Polyvinyl acetate resins and emulsions. **The Colton Chemical Company**
Vinsol—Resin derived from southern pine wood. **Hercules Powder Company**
Vinsol Ester Gum—Glycerol ester of vinsol. **Hercules Powder Company**
Vinylite—Vinyl resins: acetate, chloride-acetate, chloride, alcohol and butyral. **Bakelite Co.**
Vinymul—Polyvinyl acetate emulsion. **Paisley Products, Inc.**
Violite—Luminescent pigments. **Rhode Island Laboratories, Inc.**
Virginia Red Toners—Chlorinated lithol rubine. **Standard Ultramarine & Color Co.**
Viskoplus—Aluminum naphthenate. **Advance Solvents & Chemical Corporation**
Vistac—Rubber plasticizers. **Advance Solvents & Chemical Corporation**
Voidox—Tertiary butylated phenol. **Guardian Chemical Corporation**
Vulcan—Steel shipping containers. **Vulcan Containers Inc.**
VVF Pigments—Very fine natural iron oxides. **C. K. Williams & Company**
Vygen—Polyvinyl chloride resin. **The General Tire & Rubber Company**
Vynite—Collapsible tubes for paint pigments. **Continental Can Company, Inc.**

W

Wallkyd—Alkyd resin vehicles. **Reichhold Chemicals, Inc.**
Wallpol—Plasticized vinyl acetate emulsion. **Reichhold Chemicals Inc.**
Walltex—Wall sizings. **Hayes Adhesives Co., Inc.**
Watchung—Permanent red 2B pigments. **E. I. du Pont de Nemours & Company**
WC-130—Polyvinyl acetate emulsion. **The Bakelite Company**
Weather-Ometer—Accelerated Weathering Machines. **Atlas Electric Devices Company**
Wet-Ege Spirits—Aliphatic hydrocarbon thinner. **Anderson-Prichard Oil Corporation**
Wemco—Torque flow solids pump. **Western Machinery Company**
Witall—Tall oil dirers. **Witco Chemical Co.**
Witcarb—Precipitated calcium carbonate. **Witco Chemical Company**
Witicizers—Plasticizers. **Witco Chemical Co.**
Witco—Paint driers, surface active agents, & stearates. **Witco Chemical Company**
Witcoblak—Furnace or channel blacks. **Witco Chemical Company**
Wittox—Copper & zinc naphthenates. **Witco Chemical Company**
Wollastonite—Calcium metalsilicate extender pigment. **Godfrey L. Cabot, Inc.**
Wonex—Soda-treated wood rosin. **Newport Industries, Inc.**

X

Xacto—Positive displace meter. **Bowser, Inc.**
XR-859, XR-875 Resins—Silicone — phenolic resins. **Dow Corning Corporation**
XX—Lead-free zinc oxide. **New Jersey Zinc Co.**

Y

Yelkin—Lecithin—**Ross & Rowe, Inc.**

Z

Zeco—Asphalts, stearine pitches, gilsonite. **G. S. Ziegler & Company**
Zeolex—Ultra fine silico aluminate. **J. M. Huber Corporation**
Zinar—Zinc resinate. **Newport Industries, Inc.**
Zinol—Zinc resinate solution. **Newport Industries Inc.**
Zirco—Drier catalyst. **Advance Solvents & Chemical Corporation**
Zirex—Zinc resinate. **Newport Industries, Inc.**
Zitro—Zinc resinate. **Newport Industries, Inc.**
Zopaque—Titanium dioxide. **The Glidden Company**
Zulu—Phthalocyanine blue & green pigments. **Kentucky Color and Chemical Company**
Zytel—Nylon resin. **E. I. du Pont de Nemours & Company**

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BOOKS

Listed below are several books published during 1956 which are of interest to the coatings field.

ASTM Standards. Part IV—Paint, Naval Stores, etc. American Society for Testing Materials, Philadelphia, Pa. 1416 Pages.

Accident Prevention Manual for Industrial Operations. National Safety Council, Chicago 11, Ill. 1341 Pages.

The Chemical Constitution of Natural Fats—3rd Edition. T. P. Hilditch. John Wiley & Sons, New York 16, N. Y.

Chemie de Peintures, Vernis et Pigments. Ed. G. Champetier and H. Rabate. Dunod, Paris. Two Volumes.

Chemistry of High Polymer Degradation Processes. N. Grassie. Butterworth's Scientific Publications, London. 335 Pages.

The Chemistry of Phenolic Resins. R. W. Martin. John Wiley & Sons, New York 16, N. Y. 298 Pages.

The Fluid Agitation Handbook. Chemineer, Inc., Dayton 2, Ohio. 46 Pages.

High Temperature Technology. Ed by I. E. Campbell, John Wiley & Sons, New York 16, N. Y. 526 Pages.

The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names. K. L. Kelly, and D. B. Judd. National Bureau of Standards, Circular 558, 158 Pages.

Polyester and Their Applications. J. Bjorksten, H. Tovey, B. Harker and J. Henning. Reinhold Publishing Corp., New York 22, N. Y. 618 Pages.

Polymer Processes. Ed by C. E. Shildknecht. Interscience Publishing, Inc., New York 11, N. Y. 914 Pages.

The Systematic Identification of Organic Compounds. R. L. Shriner, R. C. Fuson and D. Y. Curtin. John Wiley & Sons, New York 16, N. Y.

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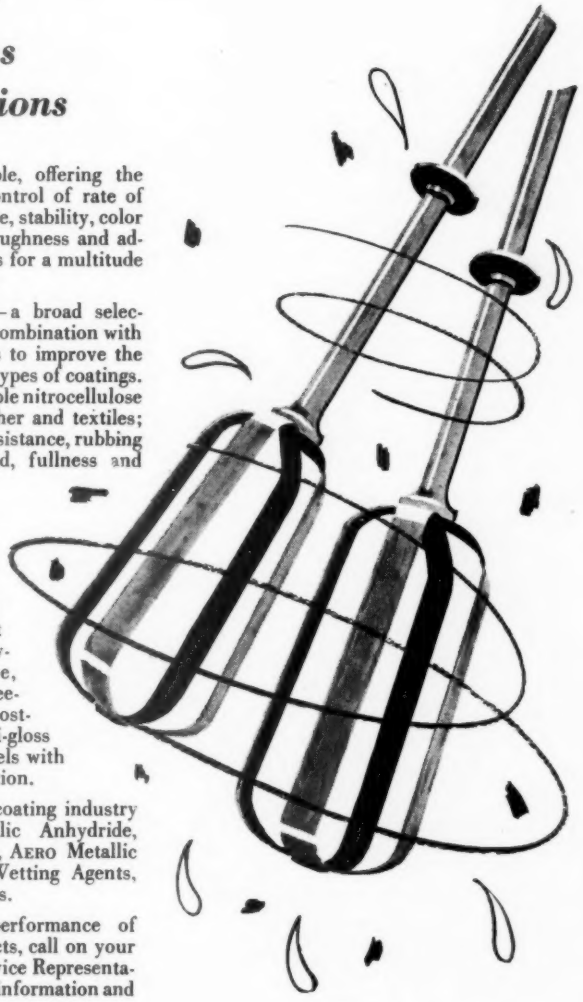

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